EDGEWOOD CHEMICAL BIOLOGICAL CENTER

Providing integrated science, technology and engineering solutions

ANNUAL REPORT 2005


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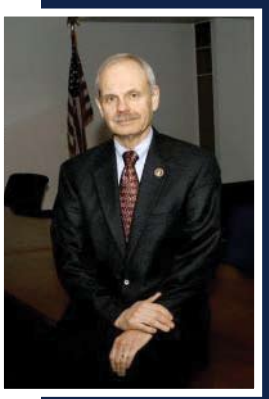
Message from the Director



As the Edgewood Chemical Biological Center (ECBC) 2005 Annual Report goes to press in early 2006, the Defense Department's commitment to "Combating Weapons of Mass Destruction (WMD)" continues to deepen. This is evidenced in the recently published Quadrennial Defense Review that states: "The Department will develop new defense capabilities in anticipation of the continued evolution of WMD threats." In 2005, ECBC extended its history of important contributions to address this major national security issue and is poised to do even more in 2006.

This report highlights 2005 technical achievements. You will see that those achievements span the entire materiel life cycle from research to demilitarization. While efforts to ensure our warfighters have the equipment to fight, survive and win on a CB battlefield dominated 2005 activities, ECBC also made important contributions in support of non-proliferation (demilitarization) counter proliferation (support to the intelligence community) and consequence management (support to domestic agencies).

The accomplishments of ECBC employees and on-site contractor personnel in support of a very broad spectrum of national needs are commendable. This Annual Report can only highlight a few accomplishments by a few performers, but our overall success in 2005 must be attributed to the dedication of the entire 1500-person workforce. I hope you take the time to examine the team accomplishments in the Report on Resources section of this document. The breadth of ECBC activities across the entire materiel life cycle is in evidence there.

This report also describes important additions to ECBC infrastructure and ECBC's human resources management activities. In 2005, we dedicated our new Advanced Chemistry Laboratory and began site preparation for the Sample Receipt Facility. In addition, we made several important non-major construction facility upgrades and additions. Also in 2005, ECBC completed its seventh consecutive year of robust hiring activity – again seeing the "hiring exceeding retiring."

In 2006, while our concerns for emerging threats and traditional vulnerabilities are not diminished, our intellectual capacity for addressing these problems has never been greater. The acquisition sophistication and technical understanding of those hundreds of ECBC engineers and scientists supporting the programs of the Joint Program Executive Office for Chemical and Biological Defense, the TACOM Integrated Logistics Support Center and the Chemical Materials Agency is superb. Competence in our five critical chemical and biological sciences capability areas (inhalation toxicology aerosol science, filtration, threat agent chemistry and biology, and agent spectroscopy/ detection algorithm development) is excellent, as evidenced by our research achievements and technology transitions. The skills of the ECBC employees engaged in field operations and consequences management activities have become relied upon by the Chemical Materials Agency, the Defense Threat Reduction Agency, the 20th Support Command and numerous domestic agencies.

To the people of ECBC, I commend you for your competence and dedication. ECBC stakeholders, partners and customers, I thank you for the opportunity you have provided the people of ECBC to address our country's national security needs.

Sincerely,

J.H. Zarzycki
Director, Edgewood Chemical Biological Center

Information about Edgewood Chemical Biological Center

ECBC is the nation's principal research, development and engineering center for non-medical chemical and biological defense. ECBC is an organizational element of the Army's Research, Development and Engineering Command, which reports to the Army Materiel Command. ECBC develops technology in the areas of detection, protection and decontamination and provides support over the entire lifecycle —from basic research through technology development, engineering design, equipment evaluation, product support, sustainment, field operations and disposal.

Vision
The premiere national resource for chemical and biological defense solutions

Mission
Provide integrated science, technology and engineering solutions to address chemical and biological vulnerabilities

Core Competence
Working with chemical and biological agents at all stages of the materiel lifecycle

Location
Edgewood Area, Aberdeen Proving Ground, MD

Established
1917

Employees
1,167 government and 396 on-site contractors*

Organization
Four Directorates reporting to the Director:

- Research and Technology
- Engineering
- Chemical and Biological Services
- Advanced Planning and Initiatives

Laboratory, Chamber, and Engineering Space
1,052,000 square feet*
Value of Physical Plant
$1,044,000,000*

Customer Base
Military, government and private industry

* As of 30 September 2005, end of Fiscal Year 05

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CUSTOMERS AND COMMUNITY
Introduction

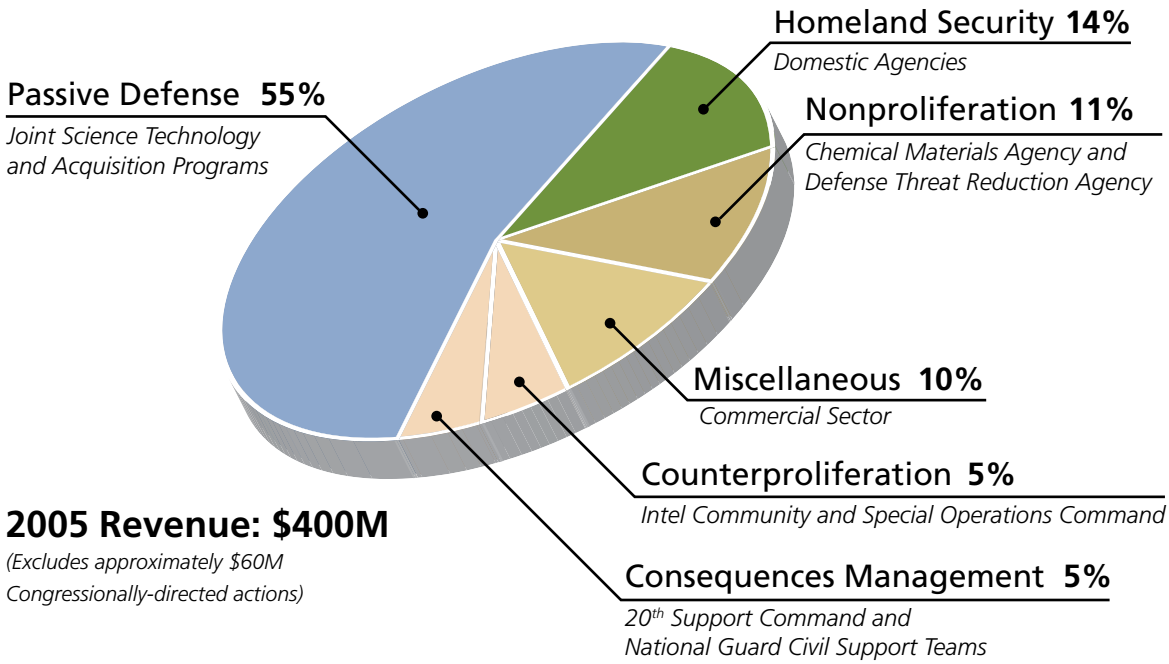
According to a survey of national security experts conducted in 2005 by Senator Richard Lugar, chairman of the Senate Foreign Relations Committee, the risk of an attack involving some form of weapons of mass destruction, such as chemical, biological, radiological or nuclear material, is extremely high. The survey suggests that the risk of such an event occurring in the next five years is as high as 50 percent.

Many government and commercial organizations are working to prevent, defend or respond to the use of chemical, biological, radiological or nuclear material. Some organizations are focused on collecting intelligence and developing programmatic strategy, others are dedicated to the acquisition of products and services and many participate by manufacturing specialized equipment and technologies. Edgewood Chemical Biological Center works with all of these organizations; applying its specialized understanding of chemical and biological materials and 90 years experience working with these materials to enable each organization to fulfill its mission. Through its support to the chemical and biological defense community at large, ECBC is fulfilling its own vision of being a national resource that is helping our nation address the threat of chemical and biological weapons.

Military strategists developed a layered approach to combating weapons of mass destruction, which includes nonproliferation, counterproliferation, passive defense and consequence management activities. In 2005, ECBC provided support to 95 customers who are executing missions in these areas, but the Center's largest contribution is in ensuring that our country has a strong passive defense program. As illustrated in the chart below, approximately 55 percent of ECBC's support was in passive defense—specifically providing detection, protection and decontamination science and technology for the warfighter.

In the area of passive defense, for the Defense Threat Reduction Agency Joint Science and Technology Office, ECBC conducted experimentation to obtain critically needed data on the behavior of chemical and biological agents in order to help answer fundamental science questions that underpin the development of equipment requirements, impact operations and refine tactics and techniques in the field. ECBC also conducted research and engineering studies that are resulting in the development of new detection, protection and decontamination technology. For the Joint Program Executive Officer for Chemical and Biological Defense, ECBC helped develop, mature and evaluate technologies to meet warfighter needs. ECBC also supported fielded items by ensuring that parts, repairs and sustainment support are in place for the life of the item.

In the area of nonproliferation, ECBC supported the Chemical Materials Agency's mission by providing expertise and manpower. ECBC's ability to safely handle agent-filled ton containers and chemical munitions has helped the Chemical Materials Agency achieve marked progress toward the destruction of US chemical weapons.



In support of consequence management, ECBC designed, built and delivered to the 20th Support Command two mobile laboratory suites uniquely suited for sampling and analyzing potential chemical and biological material in the field. ECBC scientists developed sampling and analysis methodology and trained 20th Support Command soldiers. ECBC also trained specialized military units from the 20th Support Command, Special Forces and National Guard Civil Support Teams in all facets of chemical and biological defense operations to combat weapons of mass destruction proliferation. Since 2000, ECBC has trained over 500 personnel each year on identification of chemical, biological or radiological materials, sample handling and management and decontamination techniques.

ECBC works with numerous federal agencies to strengthen homeland security. For the United States Postal Service in 2005, ECBC conducted extensive aerosol science studies in partnership with Northrop Grumman. These studies led to the redesign and delivery of new post office mail sorting equipment to post offices nationwide.

For the Department of Homeland Security, ECBC executed numerous research and development activities in 2005. Specifically, ECBC:

- Developed and demonstrated next-generation electrochemiluminescence-based biological agent assays using commercial platforms
- Designed and built two prototype All Hazard Receipt Facilities and associated protocols, which will allow public health and law enforcement personnel to safely prescreen unknown or potential threat materials
- Developed, evaluated and delivered simulation and decision tools and provided modeling and simulation support to programs responsible for planning, training, incident characterization, response and recovery
- Provided technical support to the Department of Homeland Security Center for Domestic Preparedness training facility in Anniston, Alabama

A brief discussion about ECBC's primary customers, their missions and how ECBC supports them in 2005 can be found on the next few pages of this Annual Report.

ECBC provides non-medical support to the chemical and biological defense community, developing new technologies that provide detection, protection and decontamination of chemical and biological materials. The Center works across the lifecycle—from conducting basic research to sustaining equipment once it is in use. In order to execute its mission, ECBC maintains nine fundamental capabilities:

- Chemistry and Bioscience of Chemical and Biological Warfare
- Inhalation Toxicology
- Aerosol Physics
- Filtration Sciences
- Agent Spectroscopy/Algorithm Development
- Chemical and Biological Testing and Evaluation
- Chemical and Biological Materiel Acquisition
- Agent Handling and Surety
- Chemical Munitions Field Operations

These capabilities form the backbone of ECBC's contribution to our nation's defense against chemical and biological threats.

Defense Threat Reduction Agency Joint Science and Technology Office

The Defense Threat Reduction Agency Joint Science and Technology Office is charged with managing the Department of Defense's chemical and biological defense science and technology program. The technology base program has three primary areas of emphasis—answering science questions, maintaining a robust technology base and transitioning technologies into the military acquisition system. ECBC provides significant support in all three of these mission areas.

A complete understanding of how chemical and biological agents impact human health and interact with the environment underpins equipment development, field operations and hazard assessments. A significant new finding in 2005 was the discovery that the nerve agent VX persists in concrete much longer than originally believed and can be reactivated to hazardous levels by rain. Similarly, scientists found that the nerve agent GD, an anticholinesterase agent, persists in soil and concrete and a light rain can reactivate the GD so that it outgases to the air at levels immediately dangerous to life and health. This work is described in more detail on page 16 of this Annual Report.

Transitioning technologies to the acquisition phase of the lifecycle is a critical piece of the Defense Threat Reduction Agency's science and technology mission. In support of this, ECBC transitioned two technologies in 2005 that will significantly address capability shortfall.

First, under Defense Technology Objective CB.52, ECBC addressed the need to conduct rapid chemical contamination reconnaissance. Scientists and engineers have improved the speed, accuracy and mobility of Raman spectroscopy as a technique for chemical agent reconnaissance following a chemical attack. This technology now allows for "non contact" surface contamination detection and identification via this laser-based approach.

In 2005, the Raman technology transitioned to the Chemical, Biological, Radiological, and

Defense Technology Objectives Supported by ECBC in 2005

CB.35 Standoff Biological Aerosol Detection

CB.37 Chemical and Biological Agent Water Monitor

CB.42 Environmental Fate of Agents

CB.44 Oxidative Decontamination Formulation

CB.50 Lightweight Integrated Chemical and Biological Detection

CB.51 Low-Level Operational Toxicology of Chemical Warfare Agent

CB.52 Surface Contamination Detection

CB.53 Wide-Area Aerial Reconnaissance

CB.61 Advanced Air Purification Model

Nuclear Unmanned Ground Reconnaissance Advanced Concept Technology Demonstration. Further transition for systems acquisition is programmed for 2008. ECBC scientists have developed the chemical agent "fingerprints" required to allow this technology to identify chemical agents while rejecting interferents. They have embedded these signatures into a detection algorithm that will allow automated, on-the-move, detection by warfighters conducting reconnaissance of potentially contaminated terrain.

Also transitioned in 2005 was the End-of-Life Service Indicator for the protective masks worn by warfighters. This device alerts service personnel of the remaining service life of their mask filters. Warfighters currently have no means of knowing how much residual life remains while in an operational environment, and this indicator will let troops avoid unnecessary filter changes in the field.

ECBC is developing a plan to transition the technology into the new Joint Service General Purpose Mask in 2007.

In 2005, ECBC helped the Chemical Biological Defense Program maintain a robust technology base in two ways. First, ECBC conducted research and development in the three chemical and biological defense non-medical commodity areas of detection, protection and decontamination—achieving technical advances in all areas. Second, ECBC developed and strengthened partnerships with other government laboratories, international allies, academia and the private sector to ensure that the technology base supporting chemical and biological defense is both broad and deep. Defense Technology Objectives in support of specific commodity area programs are listed in the chart on this page. Related discussions about ECBC's private sector partnerships can be found on page 13.

Joint Program Executive Office for Chemical and Biological Defense

The Joint Program Executive Office for Chemical and Biological Defense is the organization responsible for acquisition of chemical, biological, nuclear and radiological medical and non-medical defense materiel for all military services. ECBC actively supports this critical mission by supplying technology, scientific analyses, engineering and specialized personnel support.

Of the 51 Programs of Record managed by the Joint Program Executive Officer, ECBC provided either direct technology development support or matrixed acquisition-qualified personnel in support of 31 of those programs. These trained personnel serve as functional and commodity area experts. In 2005, ECBC provided approximately 225 matrixed staff members to the Joint Program Executive Officer's organization. Many of these personnel participated in the early stages of a specific technology's development and are following the technology as it enters production and fielding phases, providing unmatched technical support to accomplish a smooth transition from materiel development to field sustainment. ECBC engineers and logisticians participated in the handoff of new equipment to the warfighter and trained users in proper operation, often becoming the "face to the field" for the remainder of that equipment's lifecycle.

ECBC also provided extensive technology development support to the Joint Program Executive Office in 2005. That support included:

- Developing a new high-temperature storage program for Improved Chemical Agent Monitors currently fielded in extreme desert heat
- Providing a candidate decontamination technology for sensitive equipment and interior decontamination applications
- Launching an intensive engineering sustainment effort for the M21 remote sensing chemical agent alarm, which is being deployed well beyond its intended service life
- Adding a new capability to the M256A1 so it can detect low volatility hazards
- Developing an air sample collector efficient at the 1 micron particle size
- Conducting a down-select process to identify the most appropriate analytical equipment for the National Guard Civil Support Teams' Analytical Laboratory System

The Joint Program Executive Office for Chemical and Biological Defense executes a critically important mission for the warfighter. ECBC plays a key role in ensuring its customer has the hands-on expertise, trained personnel and unique facilities necessary for providing the warfighter the world's most effective chemical and biological defense equipment.

TACOM Integrated Logistics Support Center

TACOM's LifeCycle Management Command's Integrated Logistics Support Center, headquartered at the Detroit Arsenal, is responsible for ensuring warfighter readiness by managing sustainment activities for ground combat troops.

During 2005, ECBC was engaged in a wide variety of engineering and technical sustainment support activities for TACOM. This support included: providing engineering design, configuration management, laboratory testing and technical data for purchases of spare parts and consumable items; reverse engineering; software engineering and quality assurance activities. ECBC also verified the serviceability of chemical and biological defense equipment through shelf life testing and technical assessments.

A significant accomplishment in 2005 was the inspection and testing of 368 Improved Chemical Agent Monitors at Fort Hood, Texas. This was completed as part of the military's "RESET" program to return the equipment to optimal condition. Specifically, a problem was found with the depletion of the acetone source and system contamination from off-gassing of internal polymeric seals. These system deficiencies were investigated and corrective actions were initiated. In addition, quality issues were resolved, engineering input to procurement packages was provided and a solicitation developed.

In 2006, ECBC will continue to provide a wide breadth of technical expertise for support to the items currently in the TACOM inventory and those that will be added throughout 2006. In partnership, ECBC is helping TACOM provide maximum equipment readiness and availability to the warfighter.

Chemical Materials Agency

In 1997, the United States ratified its support for the Chemical Weapons Convention, an international treaty that prohibits the development, production, stockpile, transfer and use of chemical weapons. The treaty also calls for the destruction of all chemical weapons stockpiles around the world. The Chemical Materials Agency is the organization responsible for carrying out this mission in the United States.

ECBC has provided engineering support and trained operational personnel to the chemical demilitarization program since its inception in the late 1960s. In recent years, ECBC collaborated with Sandia National Laboratories and the Chemical Materials Agency to develop two generations of the Explosive Destruction System for safe on-site chemical agent containment during detonation of non-stockpile munitions. Detonation and then chemical neutralization take place in a sealed, stainless steel chamber that contains all of the blast, vapor, and fragments from the munitions. Since 1999, the system has been used in successful chemical munitions destruction at sites such as Aberdeen Proving Ground, Maryland and Spring Valley in Washington, D.C. In 2005, ECBC personnel deployed the system to Dover Air Force Base twice to neutralize two World War I-era mustard-filled chemical munitions that had been discovered while dredging for clams. ECBC expects to go back to Dover to neutralize additional munitions in 2006.

Also in 2005, ECBC performed testing on the second version of the Explosive Destruction System, which allows it to neutralize six munitions at one time instead of a single munition. This higher-throughput system will be used in 2006 at Pine Bluff Arsenal to destroy 1,200 munitions at that arsenal over the next 18 months. Approximately 40 ECBC personnel are stationed at Pine Bluff Arsenal for this project and other future missions.

ECBC staff helped complete demilitarization operations at Aberdeen Chemical Disposal Facility in 2005, one of the eight stockpile storage sites in the continental United States. This was a significant milestone for the Chemical Materials Agency, as the Aberdeen stockpile site was the first in the continental United States to completely destroy its stockpile. ECBC supported the design and operation of the facility, and provided 24 technicians on-site for three years. In February 2005, stockpile operations were concluded and ECBC began closing activities for the site, which include disposal of solid material and hydrolosate.

20th Support Command

The 20th Support Command was established in 2004 to consolidate the Army's chemical, biological, radiological, nuclear and explosive response capability in one organization. The Command's mission is to train, integrate, coordinate, deploy, and manage the U.S. Army Forces Command technical assets in this area. This mission includes working collaboratively with other response units and partnering with research and development organizations in other parts of the Department of Defense so that 20th Support Command personnel have the most capable equipment.

In 2005, ECBC designed, built and delivered a chemical mobile laboratory system and a biological mobile laboratory system for the 20th Support Command. These laboratory systems' unique design incorporates advanced safety, engineering and quality control systems to allow rapid high quality sample collection and analysis. ECBC also designed specific protocols and methodologies and trained 20th Support Command laboratory personnel on their use so the Command could deploy immediately to sites in the United States and abroad.

Similar to the support provided to its other military and domestic mobile laboratory customers, ECBC extended access for the 20th Support Command to ECBC's fixed-site laboratory for technical assistance and confirmation of results during deployments or missions. In 2006, ECBC will continue to provide consultation and support in the areas of engineering, product improvement, analysis and detection of chemical and biological materials.

Homeland Security Community

Many federal agencies were not concerned with chemical or biological preparedness prior to 9-11. Since that time, however, nearly all government agencies have acquired some responsibility in strengthening our nation's security against weapons of mass destruction. ECBC's support to the homeland security community has grown accordingly, and includes interagency partnerships with almost every federal agency. In response to this urgent civilian need for chemical and biological expertise, ECBC has evolved into a national resource that is providing preparedness solutions for the warfighter as well as for the domestic response community.

In 2005, ECBC expanded its work with the Department of Homeland Security. A memorandum of understanding between the Departments of Defense and Homeland Security was signed in December 2005 to establish the Chemical Security Analysis Center at Edgewood. In conjunction with the US Army Medical Research Institute for Chemical Defense and the Center for Health Promotion and Preventive Medicine, ECBC will be providing research and development support, which includes characterizing current and emerging threats; generating physical, chemical and toxicological information for developing risk assessments; identifying knowledge gaps; refining methodology for conducting forensic analysis of evidence from acts of chemical terrorism; and providing reach-back expertise in the area of chemical defense.

Other work conducted by ECBC for the Department of Homeland Security in 2005 included performing quantitative performance testing of biological detection systems for the Department of Homeland Security's BioWatch program, an early warning system of detectors placed in major urban areas nationwide that can rapidly detect trace amounts of biological materials in the air. ECBC also developed a test bed to validate the performance of experimental and developmental systems that will become future BioWatch technologies.

ECBC and the Environment Protection Agency's Office of Research and Development National Homeland Security Research Center continued collaborative research efforts, which began in 2002. Of particular note in 2005 were projects to study the fate of toxins —such as ricin—in water, efficacy testing of vaporous hydrogen peroxide on indoor building materials contaminated with biological agents, development of a database on chemical and biological agents for use by the Environmental Protection Agency and emergency responders, studies to optimize ricin decontamination methods, and development and verification of response protocols for detection of biological agents in drinking water.

ECBC also continued a long-standing relationship with the Federal Bureau of Investigations as its forensics laboratory for samples and analysis of contaminated evidence. In 2005, an arrangement to design and build an Evidence Handling and Storage Facility as part of the new ECBC Sample Receipt Facility was formalized.

For the United States Postal Service in 2005, ECBC conducted extensive aerosol science studies to understand how contaminants might be dispersed by post office equipment. These studies led to the redesign of post office mail sorting equipment and collaboration with Northrop Grumman to install over 1,000 systems in postal processing centers nationwide. In 2006, ECBC and Northrop Grumman will continue testing and modification of these systems to further improve their bio-collection and agent identification capabilities.

ECBC delivered a suite of mobile laboratories in late 2004 to the Food and Drug Administration for use at ports of entry for food and pharmaceuticals coming into the country. These laboratories were deployed in 2005 to Louisiana to assist in the wake of Hurricane Katrina. The labs are being used to conduct testing of fisheries to ensure the food supply is safe. ECBC also deployed specialists to set up the mobile laboratories to supplement the Food and Drug Administration's efforts in the Gulf Coast region.

Private Sector Partnerships

The private sector plays an important role in advancing chemical and biological defense technologies. ECBC's task as a government laboratory is to enable the private sector—industry—to better support the warfighter and homeland security. ECBC does this by sharing its knowledge and expertise accumulated from working with chemical and biological materials. In 2005, ECBC partnered with 49 firms under cooperative research and development agreements, which resulted in an infusion of ideas and knowledge that benefited the warfighter. Similarly, much of the research and development conducted to meet specific warfighter requirements can be used by the private sector to address homeland security concerns.

In 2005, Genencor International, a leading biotechnology firm, began production of its new product DEFENZ, which is an enzyme-based technology that safely detoxifies nerve agents and organophosphorus pesticides. The product can be mixed with fire-fighting foams and sprays—adding additional capability to materials already in use in the first responder community and on the battlefield. This technology was first developed at ECBC for warfighter use and was licensed for marketing and manufacture to Genencor in 2004.

Another decontamination technology, Modified Vaporous Hydrogen Peroxide, began as a medical equipment sterilant. Originally developed by STERIS Inc., this technology was widely used in hospitals and medical centers. Under a collaborative research agreement, ECBC scientists worked with STERIS to modify the technology to be an effective chemical decontaminant as well. In 2005, ECBC conducted demonstrations of this technology on military aircraft and on vehicles, including civilian ambulances. Modified Vaporous Hydrogen Peroxide is planned to be part of the Joint Program Executive Officer's decontamination program in 2007.

There are other numerous examples of how, in 2005, the private sector collaborated with ECBC to help the military advance its science and technology objectives. Some of these include:

- Guild Associates, a firm in Cincinnati, Ohio, collaborated with ECBC to develop new filtration material for use in masks and large air purification systems
- Physical Science, Inc., worked with ECBC to design and demonstrate a real-time high resolution aerial imaging and detection capability that can be installed in unmanned aerial vehicles and helicopters to "see" chemicals released near the ground
- 20/20 Gene Systems and ECBC partnered on a technology that allows the use of a hair follicle to identify and validate bio-markers indicative of exposure to low-level chemical warfare agents, an approach which may lead to a new rapid diagnostic field test

Through such partnerships, ECBC is sharing its 90 years of experience working with chemical and biological agents with the private sector to the benefit of the warfighter and the homeland.

Community and Volunteerism

This year ECBC employees were generous with their time and talents, reaching out to local students and families in the communities near Aberdeen Proving Ground.

In 2005, ECBC scientists helped administrators of the new Science and Mathematics Academy at Aberdeen High School refine their curriculum and provided expertise to teachers and students. The academy, which enrolled its first class in September 2004, provides gifted high school students the opportunity to experience challenging coursework in science, mathematics and technology with an emphasis on real world application. ECBC serves as a co-chair of the academy's advisory board and in 2005, helped guide curriculum content, served as an informational resource for teachers and assisted in creating the Program for Academic and Career Exploration, which places students with scientist mentors at Aberdeen Proving Ground. ECBC also hosted a visit to Edgewood for 48 sophomores enrolled in the program, and toured the students through ECBC's new Advanced Chemistry Laboratory, the McNamara Life Sciences Facility and the Berger Engineering Laboratory where they had hands-on experiences in the prototyping lab, computer-aided design facility and robotics lab.

As part of the Kids and Chemistry program, ECBC staff members conduct science activities with local public school students. In 2005, 14 volunteer scientists worked with nearly 100 local fifth-graders, leading in-classroom experiments that explored chemical reactions using polymers and demonstrated how changes in pH and temperature affect the rate of a chemical reaction. Ten ECBC volunteer scientists participated in National Chemistry Week at the Edgewood and Bel Air public libraries, conducting interactive experiments relating chemistry to toys with over 100 participants, some as young as six years old. Kids and Chemistry volunteers also participated in ECBC's organization day and made a visit to Eden Mill Nature Center to share science with a group of students learning about environmental chemistry. In total, ECBC scientists worked closely with over 250 local students, sharing their passion for the field of science.

In May 2005, ECBC was selected to serve on the Harford County Program Advisory Committee for the development of a first-in-the-nation high school curriculum in Homeland Security and Emergency Preparedness, a program that will be piloted at Joppatowne High School in Joppa, Maryland. ECBC helped conduct a needs assessment, establish the Homeland Security Sciences Program Sequence and identified courses of instruction that would be taught under this sequence. ECBC also helped obtain program approval and secure funding for this pioneering effort. Because of its involvement in this program, ECBC was also selected to serve on a Maryland State Department of Education advisory council and invited to participate at the national level working with the Department of Education.

For over eight years, ECBC engineers have participated in the Volunteers for Medical Engineering program to improve the independence of individuals with disabilities through innovative engineering. In 2005, employees worked on projects including the design of a brake system for an office chair; shower chair modifications and a wheelchair drive system and prosthetic devices. An ECBC engineer won an award for his work with a wheelchair-bound expectant mother in 2005.

APG Civilian Volunteer of the Year

Larry Oswald was chosen as the 2005 APG Civilian Volunteer of the Year. He donated his time and talents on the modification of a baby crib for a wheelchair-restricted expectant mother, which enabled her to more easily care for her newborn child. Oswald has been working with the Volunteers for Medical Engineering program for over ten years.

HIGHLIGHTED 2005 ACCOMPLISHMENTS

Answering Fundamental Science Questions about Chemical Agents

Researchers at ECBC are learning more every year about chemical agents and their impact on human health and the environment. Better investigative technologies, such as nuclear magnetic resonance, allow researchers to explore deep inside environmental samples to better understand how agent interacts with different materials. From this research, scientists understand much more about the properties and effects of chemical agent exposure and are applying this new understanding to refining toxicity estimates, updating equipment requirements and changing basic field operating procedures for warfighters and emergency responders.

In the Agent Fate program, which was a major research initiative at ECBC in 2005, researchers are studying what happens to chemical agents when they have contaminated operationally relevant surfaces such as concrete and soil. The program addresses the following questions: What effect will different surfaces have on the behavior of agents? What are the vapor and contact hazards? How much impact do environmental conditions have on a contaminated surface? When will a surface be safe?

Currently, field manuals and other sources of information conflict. An example of this conflict is found in comparing the Army Field Manuals 3-4 and 3-9, which are technical manuals used by warfighters to determine operational procedures. One manual claims that nerve agent on grass is a vapor hazard for 18-20 hours after contamination; for the same environmental conditions, the other manual claims the vapor hazard exists 1800-3600 hours after contamination. Through advanced research techniques and rigorously validated data, scientists are working to provide authoritative data and resolve conflicting information.

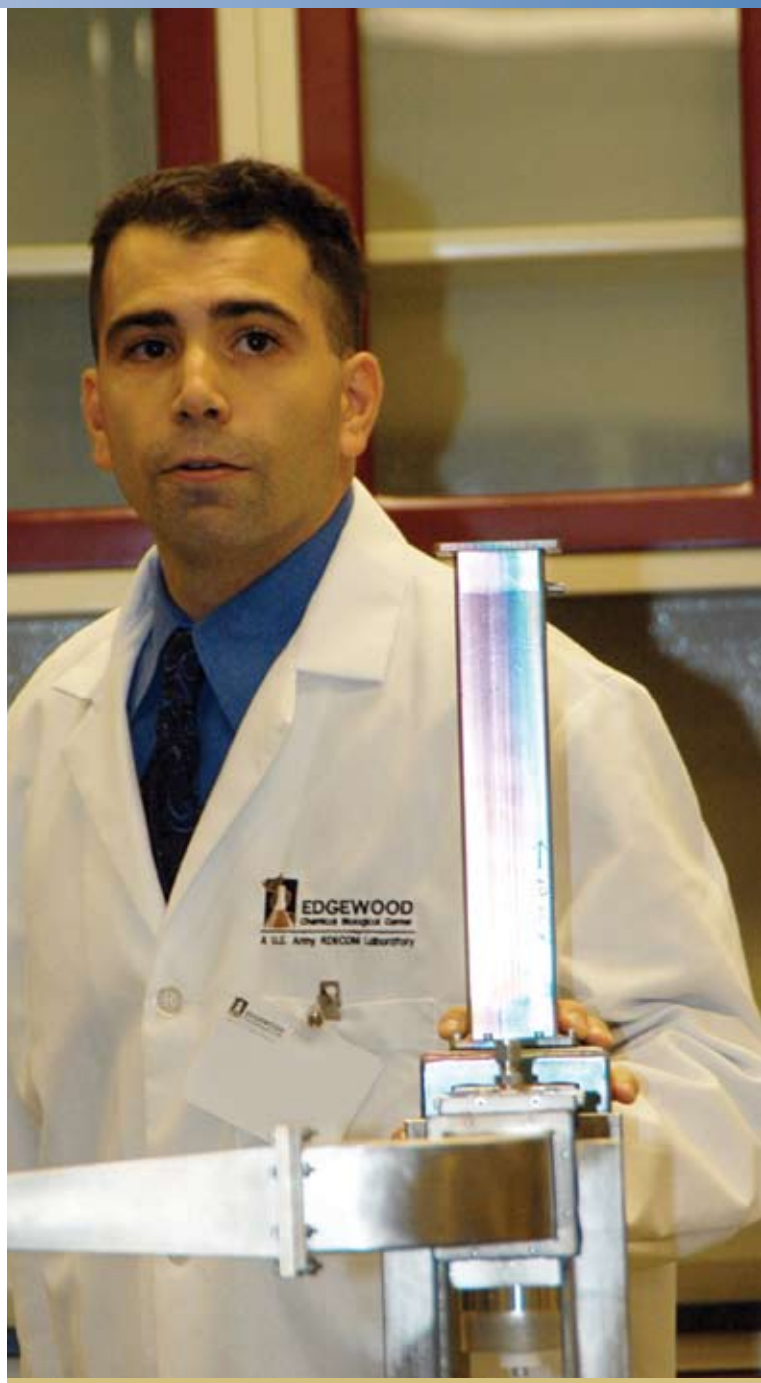
There are two major areas of experimental focus in the Agent Fate program—measuring the evaporation rates of agents from surfaces and understanding the surface interactions and chemistry. Important variables being studied include temperature, wind speed, relative humidity, agent drop size, surface and agent. Surfaces investigated include terrain materials such as sand, soil and grass as well as infrastructure building materials like concrete and asphalt. To test every possible combination of agent, surface and environmental conditions would require

over 10,000 experiments so researchers developed a "design of experiments" approach to focus research on key combinations and perform trend calculations for others. This approach reduced the total number of experiments to be conducted, but scientists still faced conducting thousands of experiments in order to obtain the high-fidelity data necessary.

In 2005, ECBC completed the design and development of a wind tunnel capable of matching all of the desired environmental conditions, including temperature and wind profiles, while fitting within a standard chemical fume hood. To complement the tunnel, new vapor sampling devices were developed with more versatility to cover a broader range of agents and surfaces. This instrument enables the measurement of evaporation processes with precise wind speed, temperature and relative humidity controls and multiple video and vapor monitoring capabilities. The wind tunnel design was replicated to create eight functioning wind tunnels in order to complete the research in 2006.

Another part of Agent Fate research included studying surface/agent interactions and chemistry. Agent may adsorb into a porous surface and be trapped until conditions change. In 2005, ECBC scientists learned surprising new information about chemical agents and their interaction with surfaces. Mustard agent, for instance, is more persistent in porous materials than anticipated and may not be detectable by traditional field methods. Also, the reaction products for mustard in concrete contain a mixture of toxic and non-toxic materials. Furthermore, a light rain may cause agent trapped in porous materials to resurge as a vapor hazard. This was shown for 34 rain events over three weeks on the same original sample. This data prompted the Air Force to change their operating procedures. Similarly, researchers found that the nerve agent VX, an organophosphate similar in chemical structure to pesticides, persists in soil and concrete much longer than originally thought and can be reactivated by rain events. This data has been incorporated into military prediction tools and operating manuals, which previously had underestimated the hazards of chemically contaminated surfaces. Researchers also shared the new data in 2005 with the scientific community, delivering over 25 presentations, journal articles and technical reports.

As the research continues into 2006, ECBC expects data from the Agent Fate program to not only refine operating procedures and predictive tools that assist authorities to determine the best course of action after a contamination event, but to have a major impact on other programs. The low level chemical warfare agent toxicology research program will benefit from the technical data produced by the Agent Fate program by determining the toxic hazard associated with agents on and within surfaces. Similarly, decontamination studies and the Agent Fate program work together in a synergistic and complementary fashion to produce a more complete picture of the chemical agent hazards and methods of mitigating the threat.



The Environmental Fate of Agents research is conducted under the auspices of Defense Technology Objective CB.42. Defense Technology Objectives are recognition of the most important defense science and technology activities and are reviewed by both Department of Defense senior managers and Congress.

Understanding Viruses

"Both history and science clearly tell us that influenza pandemics are inevitable. The next pandemic could emerge from the current H5N1 strain that now affects numerous countries in Asia, Europe, the Middle East and Africa. The next pandemic also could emerge from another influenza strain, and we must be ready for both of these possibilities," said Centers for Disease Control and Prevention Director Dr. Julie Gerberding, in testimony before Congress in March of 2006.

President Bush's November 2005 National Strategy for Pandemic Influenza states that in any given year, seasonal influenza viruses cause 36,000 deaths and cost $10 billion nationwide. Worse, a pandemic in this country, such as the one in 1918, could kill millions of Americans and wreak havoc on our economy and way of life.

Understanding the properties of viruses and how we can protect the warfighter is a critical part of ECBC's mission. While much of the national strategy is focused on medical countermeasures such as vaccines, ECBC's focus is on answering the fundamental science questions about viruses and their behavior in the environment, and providing physical countermeasures such as rapid detection and identification devices, and high-fidelity simulants that researchers can safely use in the laboratory to further scientific understanding of viral threats.

Understanding Viruses

Understanding How Long a Virus is Infectious

ECBC completed a major study in 2005 on the inactivation rate of viruses following release into the environment, either as a deliberate act of terrorism or through human transmission such as a cough or sneeze. This study, published in the Journal of Virology in November 2005, found a correlation between the amount of sunlight a specific geographic location receives and the rate of inactivation of a virus released in that location.

It is known that ultraviolet radiation in sunlight is the primary virucidal agent in the environment but different cities in the world have widely varying exposure to sunlight, primarily based on time of year, latitude, and cloud cover. Prior to this work done at ECBC, scientists had no way to predict how long a virus would remain infectious based on where and when it is released into the environment.

Two types of solar radiation—direct and indirect—can inactivate viruses and are roughly equal in intensity on a clear day. Climate, pollution, cloud cover and ozone levels lower the intensity of solar radiation, and reduce virus inactivation. Interestingly, even shadows from natural or artificial structures, such as trees and buildings, can provide the protection needed in order for a virus to remain infectious.

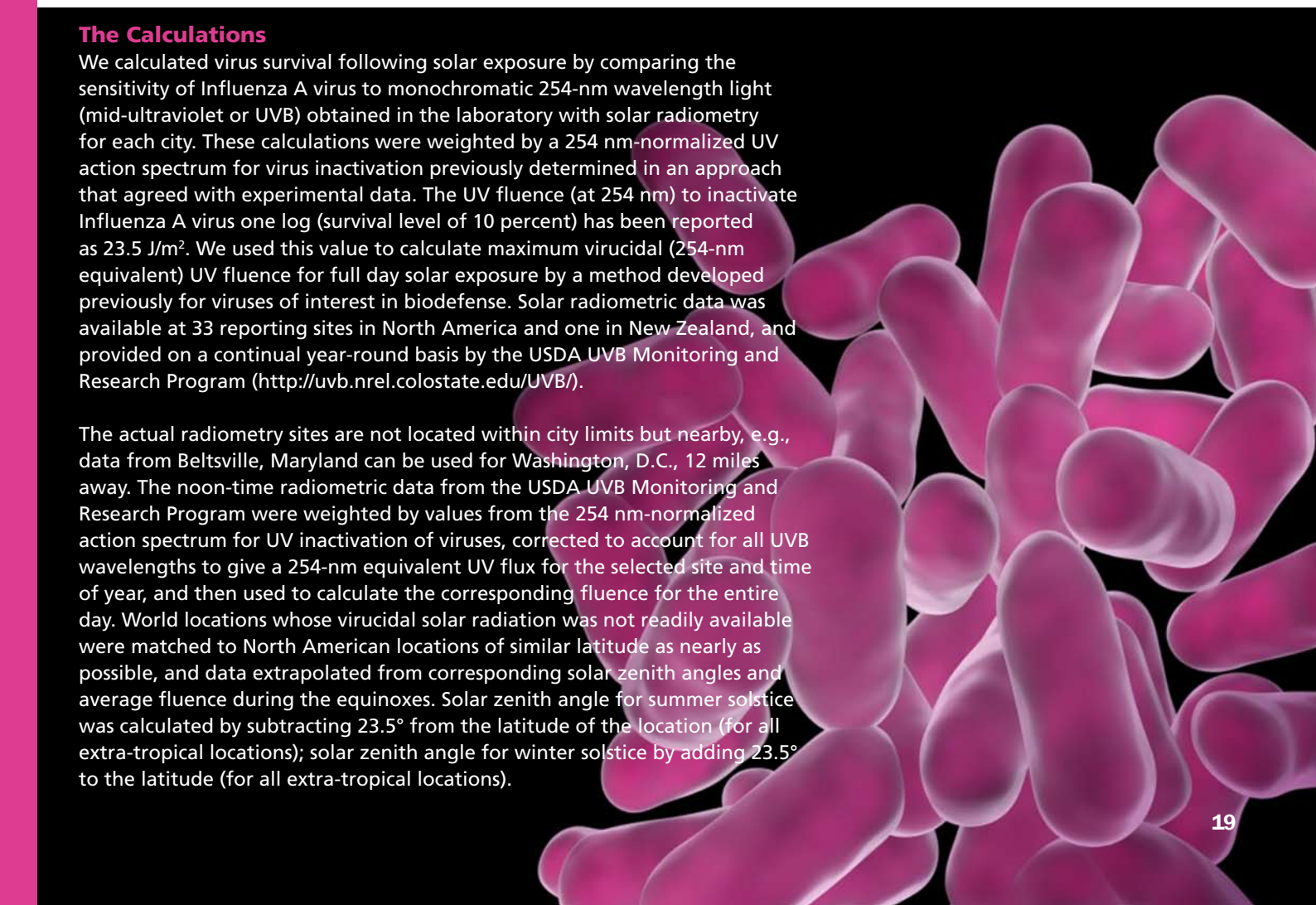
Using these variables, ECBC scientists found that at the beginning of the usual flu season (December), influenza virus exposed to full sunlight will be reduced by 99 percent (2 logs) during a single day in Miami and in Mexico City, and by 90 percent (1 log) in Los Angeles and New Delhi, but will remain infectious in London, Seattle and other northern cities because of the low levels of solar radiation. This allows continued risk of re-aerosolization and human infection. By spring equinox, solar inactivation improves in parallel with a general decrease in flu cases. The correlation between low and high solar radiation and high and low disease prevalence, respectively, suggest that inactivation of viruses in the environment by solar radiation plays a major role in the seasonal occurrence of influenza contagion.

The predictive model developed by ECBC will be used by military planners and it also can be applied by countries around the world to prepare for influenza outbreak.

The Calculations

We calculated virus survival following solar exposure by comparing the sensitivity of Influenza A virus to monochromatic 254-nm wavelength light (mid-ultraviolet or UVB) obtained in the laboratory with solar radiometry for each city. These calculations were weighted by a 254 nm-normalized UV action spectrum for virus inactivation previously determined in an approach that agreed with experimental data. The UV fluence (at 254 nm) to inactivate Influenza A virus one log (survival level of 10 percent) has been reported as 23.5 J/m^2. We used this value to calculate maximum virucidal (254-nm equivalent) UV fluence for full day solar exposure by a method developed previously for viruses of interest in biodefense. Solar radiometric data was available at 33 reporting sites in North America and one in New Zealand, and provided on a continual year-round basis by the USDA UVB Monitoring and Research Program (http://uvb.nrel.colostate.edu/UVB/).

The actual radiometry sites are not located within city limits but nearby, e.g., data from Beltsville, Maryland can be used for Washington, D.C., 12 miles away. The noon-time radiometric data from the USDA UVB Monitoring and Research Program were weighted by values from the 254 nm-normalized action spectrum for UV inactivation of viruses, corrected to account for all UVB wavelengths to give a 254-nm equivalent UV flux for the selected site and time of year, and then used to calculate the corresponding fluence for the entire day. World locations whose virucidal solar radiation was not readily available were matched to North American locations of similar latitude as nearly as possible, and data extrapolated from corresponding solar zenith angles and average fluence during the equinoxes. Solar zenith angle for summer solstice was calculated by subtracting 23.5° from the latitude of the location (for all extra-tropical locations); solar zenith angle for winter solstice by adding 23.5° to the latitude (for all extra-tropical locations).



Understanding Viruses

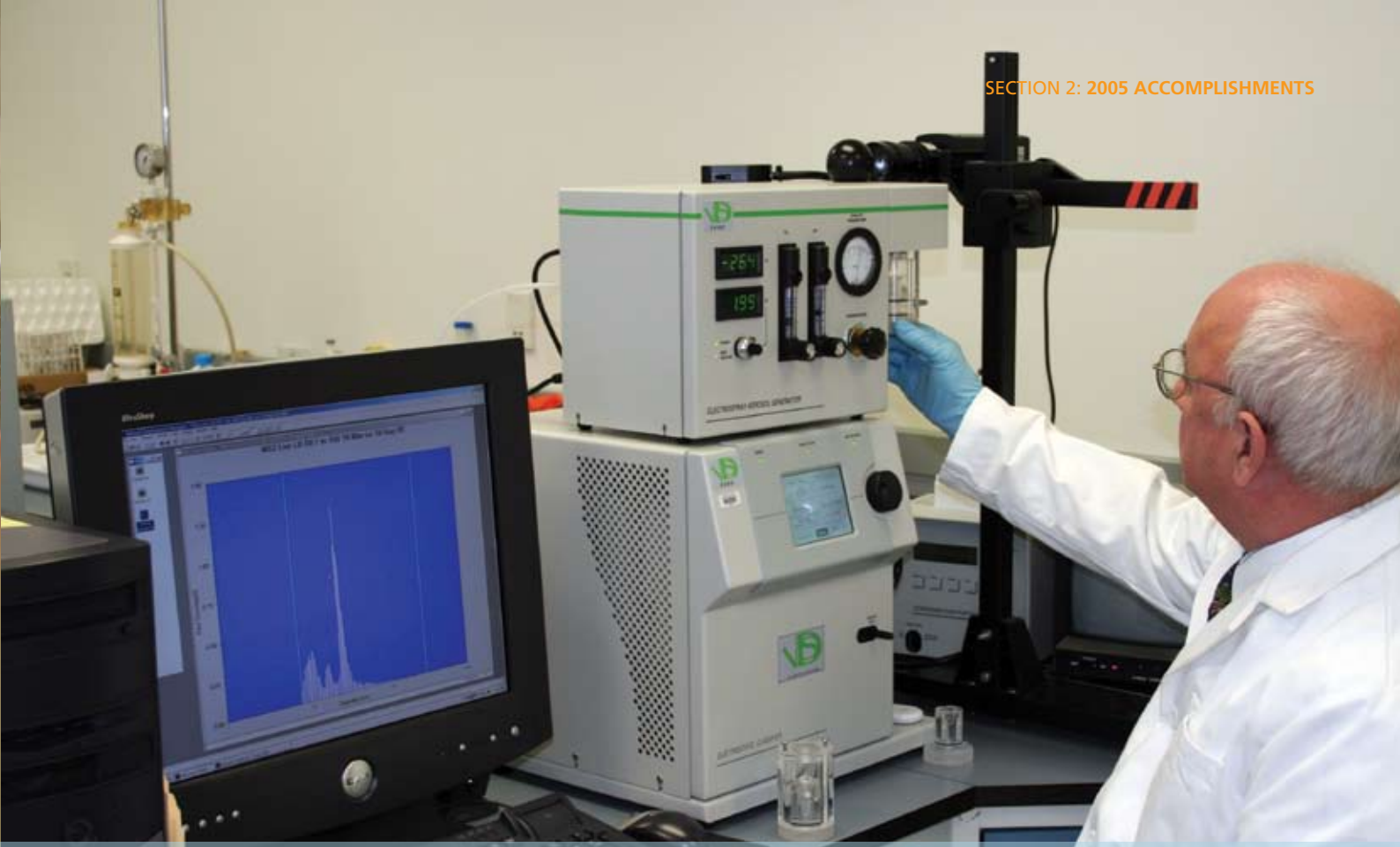
Viral Simulants

In order to develop a thorough understanding of viruses and optimize countermeasures, thousands of laboratory experiments must take place. In certain situations working with a pathogenic virus is necessary. However, many of these experiments may be conducted using a simulant virus that mimics the properties of the real virus but is far safer to work with. For scientists, a simulant reduces the risk of exposure to an infectious disease and increases their productivity because of reduced logistical requirements. It also allows more accurate equipment testing in large chambers or out of doors, which is necessary in order to assess system performance but cannot take place with pathogenic virus material.

An ideal simulant shares general physical and biological properties with the pathogen of concern, but is not infectious to humans. The harmless bacteriophage MS2 has been used for decades in the biodefense research, development, testing and evaluation communities but has several drawbacks. Most importantly, it is not the same size or shape as most of the recognized viral threat agents, and in particular, lacks similarity with orthopoxviruses, a family that includes variola virus, the causative agent of smallpox.

ECBC scientists are in the forefront of the search for more suitable simulant viruses. In recent years, attention has been focused on a group of simulants known as baculoviruses, which have been used safely for decades as "natural" anti-insect agents. While non-pathogenic to humans, other higher animals and plants, viruses in the baculovirus group resemble poxviruses in their physical construction, size and genome composition much more closely than bacteriophage MS2. Recently, ECBC developed antibody-based and polymerase chain reaction assays for the detection of baculoviruses.

In 2005, ECBC scientists filed a patent application for the use of baculoviruses as simulant viruses in biodefense work. ECBC is also pursuing a collaboration with our French Ministry of Defense counterpart, the Centre d'Etudes de Bouchet, which also has an interest in pursuing this research.



Understanding Viruses

Rapid Detection of Viruses

Current methods of virus detection and identification, which rely on the use of antibodies and reagents, are effective for clinical use but have several limiting factors when applied to use in the field. Specialized skills and equipment and extended analysis time are required in order to accurately analyze a sample for the presence of a virus. This makes rapid, accurate detection of a virus before it infects a large population of soldiers or civilians a difficult feat to accomplish.

A rapid field screening system for viruses would be a valuable capability, particularly as the threat of a possible pandemic caused by a flu virus or genetically engineered threat becomes of greater concern to the international science community. In 2005, ECBC achieved a milestone in this area with the development of a new Real Time Non-Specific Viral Detection system, which uses analysis of the physical properties of viruses in order to allow initial field screening of an environmental sample. Viruses are collected, sized and a concentration determined without the use of biochemical reactions. The system also can count known viruses, unknown viruses (viruses without names), mutations and virus-like particles at the same time and in the same sample.

A small amount of sample is placed into a capillary tube in a sealed chamber. The sample is then aerosolized into an electric field where the individual particles become electrically charged. The charged sample then is passed into a column in which an electric field surrounds the charged particles. The speed of each particle's travel through this electric field is proportional to the mass/charge ratio of the particles. After passing through the chamber, the particles then pass into a counting chamber where the number of particles of each mass/charge ratio (e.g., size) is scored. The data are then processed in a computer where the mass/charge ratios are converted to an estimate of the size of the particles. A video display then shows the distribution of particles by size and concentration. Results are stored to a file, which can then be further analyzed in a laboratory in order to confirm the identity of the virus.

In 2005 the system successfully detected Influenza A (91nm) - the bird flu - and examined its stability over time, and Influenza B (102nm). It has detected several of the hepatitis viruses, as well as others of interest from a wide selection of environments. This new approach provides for a quick means to create dose-response or fate curves for viruses of interest and various treatments, such as antiviral drugs, temperature, pH and outdoor exposure. In 2006, scientists are looking to partner with industry to reduce the size of this technology so that it can be made into a portable virus detector. Its value to the military and civilian medical and emergency responder community would be its ability to accurately screen large numbers of samples in a small amount of time and at a fraction of the cost of the more extensive antibody-based identification systems.

Detecting Low Volatility Materials

As the potential chemical warfare threat has grown to include the possible use of toxic industrial chemicals and military threat agents with low volatility properties, the detection equipment carried by the warfighter must be enhanced. In order to quickly field a capability to address low volatility materials, ECBC adapted existing chemical detection equipment to meet this need.

Fielded equipment relies on agent in its gas phase— vapor—passing through the detection mechanism. Low volatility materials have little or no matter in the gas phase and consequently low vapor pressure. ECBC scientists found that by simply engineering a heating mechanism into the detector, more material could be transported for detection.

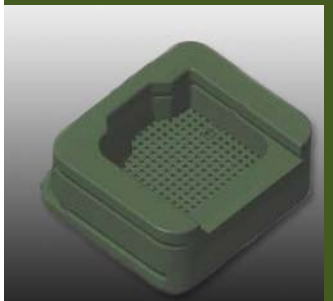
In 2005, ECBC scientists and engineers focused on modifying the M256A1 Chemical Agent Detector by adding a new capability that collects liquid and solid samples. Engineers and scientists had in previous years devised a simple but ingenious small plastic adaptor that clips onto the M256A1 sampler. Using this adaptor, a liquid or solid sample collected using M8 paper or M9 paper is attached to the M256A1 and heat is applied to raise the sample temperature so that enough vapor is produced to allow detection to take place. ECBC developed and fielded 3,000 kits within three weeks. Also in 2005, ECBC created several design configurations for this new kit and conducted an evaluation with users to gather feedback on preferred configuration. ECBC also fabricated test items and developed a test plan to perform required technical testing. ECBC is conducting this testing in 2006.

In 2006, ECBC's emphasis will be on further improving the low volatility detection system and adding quality and reliability to the M256A1 kit. ECBC will be working with the manufacturer to review the current manufacturing process and technical data package to determine ways to add more functionality.

The M22, an automatic chemical agent alarm system capable of detecting and identifying standard blister and nerve agents, was adapted for detection of low volatility compounds in 2005. Engineers developed a unique inlet and agent collection device to capture and process agent samples and a thermal or insulated wrap was developed to maintain required internal temperatures in cold weather. ECBC also conducted environmental, field and laboratory tests and analyzed test results which led to refinement of the detection algorithm for this new version of the M22. The M279 Surface Sampling System, an M22 auxiliary item, was also enhanced by ECBC for cooperative use with the modified system. Specifically, the M279 internal components were upgraded to provide the required heat for the sampling mission.

In ECBC's research laboratories, scientists are also working to integrate detection of low volatility materials into remote sensing technologies, such as the M21. Remote chemical sensing can be accomplished by analyzing infrared light emitted or absorbed by a chemical cloud and identifying the presence of agents in the cloud by comparing its spectral signature—or unique optical fingerprint—to that of a baseline library signature, typically one that is acquired in a laboratory with the actual agent. Recently, ECBC has added spectral signature data for low volatility materials to this library of agent signatures and in 2005, enhanced the accuracy of these reference signatures by developing a new method, called spectroscopic ellipsometry, to measure optical constants of solids and liquids. The Joint Services Lightweight Standoff Chemical Agent Detector, which employs infrared spectroradiometry and the Artemis, which employs infrared laser light detection and ranging technology to detect hazardous clouds at kilometer distances, both rely on accurate knowledge of these optical constants.

Low volatility materials are an area of concern for today's warfighter but not an insurmountable problem. With creative engineering and careful science, ECBC put new capabilities in the hands of the warfighter in 2005.



Advancing Air Purification Technology and Application

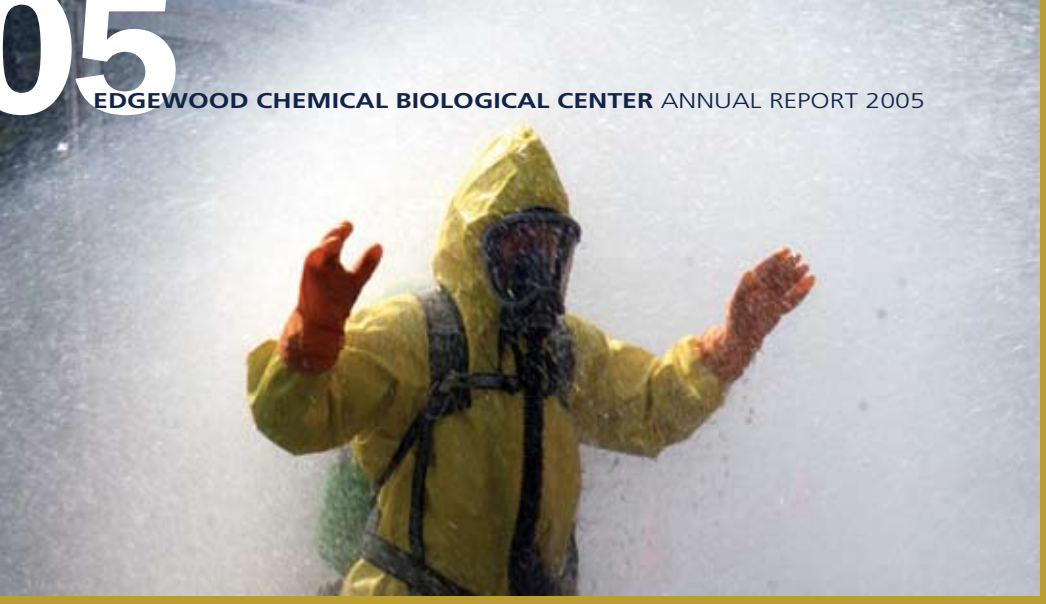
Air purification technologies allow warfighters and first responders to operate in contaminated environments. Protective masks are used by fire fighters in smoke-filled environments and by warfighters when the threat of toxic materials is present. Air purification technologies are also widely used in buildings and vehicles to protect the occupants against contamination. ECBC's work in this area is focused on developing new engineering controls and filtration materials that ensure a contaminant-free environment for warfighters and civilian workers.

Highly visible government facilities, particularly in the nation's capital, and facilities where sensitive operations take place, are considered by homeland security experts as targets for possible terrorist attack. Much has been done to address these facilities' vulnerabilities, including designing and installing air filtration systems to protect against chemical, biological or radiological contamination. In 2005, ECBC installed new air filtration systems in several facilities across the nation. Additionally, ECBC engineers and technicians provided follow-on support, including continuous surveillance, preventative maintenance and regular re-certification services of existing systems. Because of ECBC's efforts in 2005, critical government facilities have state-of-the-art protection.

Carbon is the primary filtration material used in protection systems. When impregnated with certain metals, the carbon filter can protect against a wider range of threats. In 2005, ECBC and its commercial partners advanced the technology of filter media and made available a new filter material formula for incorporation into fielded systems. Specifically, ECBC conducted qualification testing of M48A1 and M98 filters incorporating an advanced adsorbent designed to protect against toxic industrial chemicals. Full qualification, technical data documentation, and transition to the field are expected to be completed in 2006.

In addition to designing new filtration materials, ECBC is enhancing new air purification system technologies for use in buildings and vehicles. For example, regenerative filtration is a self-cleaning air handling system that eliminates the need to change filters in a contaminated environment. A regenerative filtration system employs two adsorption beds—one to filter the incoming air while a second is regenerated by low-pressure or high-temperature purging. In this way, operating and lifecycle costs are reduced and mission effectiveness is improved. In 2005 ECBC began studying how to incorporate a regenerative filtration system into the new Expeditionary Fighting Vehicle, an amphibious fighting vehicle being developed for the United States Marine Corps that is scheduled to enter production in 2007.

Another air purification system under development is catalytic oxidation. This technology uses high temperatures to destroy chemical and biological threats. Widely used in industry, ECBC is working in collaboration with industry partners to adapt catalytic oxidation technology for military application. In 2005, ECBC worked with industry to mature the technology and improve its scalability. Also, ECBC tested the technology and demonstrated its effectiveness against toxic industrial materials of interest to the military and the homeland defense community.



Developing a New Decontamination Standard

Existing methods for evaluating the effectiveness of sporicidal treatments needed improvement to be more quantitative, rapid, economical, flexible and environmentally friendly. Last year, ECBC scientists developed an improved method for evaluating the effectiveness of sporicides, such as decontaminants for defense applications and products for household or commercial use. This new test method was adopted in 2005 as the new international standard by the American Society for Testing and Materials (ASTM). This standard is known as E 2414-05, Quantitative Sporicidal Three-Step Method to Determine Sporicidal Efficacy of Liquids and Vapor or Gases on Contaminated Carrier Surfaces.

The method has several advantages. Instead of a 30-day wait, results are produced via overnight incubation. Carrier surfaces are inexpensive enough to be disposable. Also, this test method uses small volumes of material for testing and produces much less biological waste.

The method will allow military and medical communities to better determine the effectiveness of current sterilants and decontaminants. It also has application on a variety of commercial segments that need testing and evaluation of decontaminants and sterilizing agents for food processing, as well as for bactericidal soaps, lotions, cleaners, paints and many other products for household and commercial use that can involve microbicidal activity. Within ECBC, the new method has been used in laboratory studies conducted in connection with the anthrax mail attacks and in military operations in Afghanistan and Iraq.

2005 Defense Standardization Program Achievement Award Winner

Dr. Jose-Luis Sagripanti was named Army winner of the 2005 Defense Standardization Program Achievement Award for his work in the development of a standard test method for efficacy of decontamination products.

The method was adopted by ASTM International as Test Method Standard E 2414-05, "Test Method for Quantitative Sporicidal Three-Step Method to Determine Sporicidal Efficacy of Liquids and Vapor or Gases on Contaminated Carrier Surfaces."

Strengthening the Industrial Base

The rapid build-up and ongoing support of chemical and biological defense equipment deployed for Operation Enduring Freedom and Operation Iraqi Freedom has stressed the current manufacturing support infrastructure. Unavailable parts and material shortages could place our warfighters at risk for not having the right piece of equipment when they need it.

In 2005, ECBC worked hard to identify new sources of parts and material for fielded equipment. Aggressive market research and engineering innovations have been key factors in strengthening the industrial base for several pieces of equipment. The M12A1, originally fielded 35 years ago, is still the military's large-area decontamination device of choice. Several years ago, ECBC redesigned the system to convert the engine to diesel power and included parts and design changes in order for it to perform well in desert conditions. The redesign greatly improved the operational readiness of the system, increased reliability, simplified operations, and met the Department of Defense requirements for fuel standardization. Then in 2005, ECBC engineers developed a sustainment plan to support the M12A1 at a reasonable cost over the next 10 to 15 years.

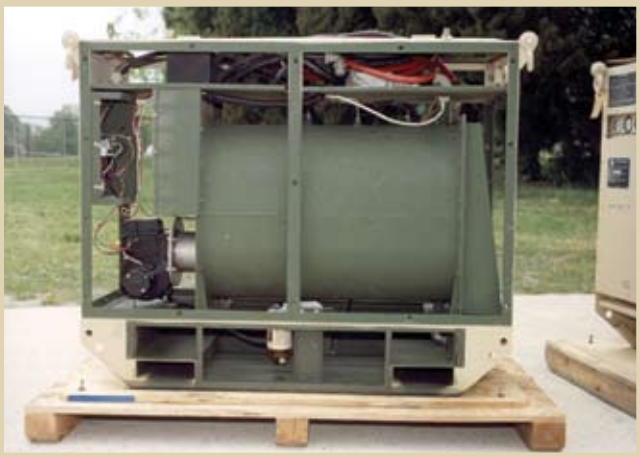
The M291 Skin Decontamination Kit is used to clean the skin when it has been contaminated by liquid chemicals and is regulated by the Food and Drug Administration as a medical device approved for use on skin. In 2005, in order to meet the demands for this item to support warfighter deployments, the industrial base for the M291 needed to be expanded to include a second source of supply, in addition to the production capability at the Pine Bluff Arsenal. TrueTech was identified as a source of supply, and will begin production. Together, Pine Bluff Arsenal and TrueTech's production capabilities will ensure an adequate supply of this item for the warfighter.

The M21 Remote Sensing Chemical Agent Alarm is designed to provide warfighters standoff chemical agent detection so they can identify and maneuver around contaminated areas. It can detect both nerve and blister agents at distances up to five kilometers. The M21 is an aging system and plagued by material shortage issues and lengthy repair times. In 2005, ECBC conducted site visits with users to get direct feedback, analyzed repair activity and modified maintenance concepts to reduce cost of system repairs. Additionally, ECBC engineers recommended corrective actions to improve the M21's overall readiness status and arranged for retention of key parts with Defense Logistics Agency and the identification of alternate sources of supply. Together, these changes improved depot level maintenance, repair times and overall readiness status.

ECBC also operates the Chemical, Biological, Radiological and Nuclear Equipment Hotline, which in 2005 received 343 inquiries from warfighters looking for a single source of accurate technical information on chemical and biological products and equipment. Through this hotline, not only are users able to get authoritative information on chemical and biological equipment, but engineers can study the inquiries to gain insight for equipment developers as they look to improve fielded equipment.

Additional Sustainment Activities in 2005

M17A1 Decontaminating Apparatus	· Resolved Obsolescence Issues
Chemical Agent Monitor/ Improved Chemical Agent Monitor	· Engineering Support for Spare Parts · Sustainment Production Contract
Chemical Biological Protection Shelter	· Engineering Support for Spare Parts
M40A1 Mask, M42A1 Mask	· Sustainment Production Contract · Sustainment Support for Spare Parts
M45 Mask, M48 Mask	· Sustainment Support for Spare Parts



Working closely with TACOM and the Defense Logistics Agency and private industry, ECBC has maintained a proactive engineering and industrial base program, achieving major progress in 2005 toward improving long-term sustainment of chemical and biological equipment for the warfighter.

Helping Albania Destroy its Stockpile

Cooperative threat reduction programs, also known as Nunn-Lugar programs after US Senators Sam Nunn and Richard Lugar who sponsored the original legislation in 1991, have helped the newly independent states of the former Soviet Union destroy their weapons of mass destruction. The Defense Threat Reduction Agency's Cooperative Threat Reduction Program is responsible for coordinating United States' effort in this undertaking. In 2005, ECBC traveled to Albania to help that country begin the process of destroying 19 metric tons of chemical material.

Thirteen ECBC demilitarization experts traveled to Albania to assess and verify counts of containers and weights, and perform chemical characterization of the stockpile. ECBC completed data collection at the stockpile site, which is near the capital city of Tirana, from March to April of 2005, and reported stockpile composition characteristics, including metals content and other impurities. ECBC also verified that the Albanian government made the correct submissions detailing its chemical weapons inventory to the Organization for the Prohibition of Chemical Weapons, as required by the Chemical Weapons Convention treaty. Similarly, ECBC supported the Defense Threat Reduction Agency in evaluation of proposals for technologies that could be used in Albanian chemical warfare destruction.

In addition to performing the on-site work, ECBC helped finalize health and safety plans, procedures and operations. In 2006, ECBC will conduct follow-on work in support of demilitarization of the stockpile and site clean-up, including deploying equipment for the operations that will start in June 2006, and conducting monitoring during the process to verify agent destruction. Collective protection equipment will also be installed to protect workers and the environment during the destruction process.

Protecting the United States from the threat of weapons of mass destruction includes destroying chemical agent stockpiles around the world. If left alone, agent could fall into the hands of terrorists. At home and abroad, ECBC staff members are applying their expertise to ensure the safety of citizens and the health of our environment.

In Kuwait

Packaging Equipment for Rigorous Shipping

Over the years, the military has learned that proper packaging of equipment sent to or from the theater of operations is a complex logistics issue. The Defense Logistics Agency declares in their publication *The History and Significance of Military Packaging* that "[packaging] remains a dynamic force that can either provide a positive or negative contribution to the success of military missions. Unlike most elements of military doctrine, military packaging is rarely understood and appreciated for its contributions." Still today, a specialized piece of equipment needs to arrive on time and in top shape in order for a unit to complete a mission.

Military shipping, distribution and retrograde operations subject packaged equipment, supplies and spares to extreme conditions and adverse environments. Even items transported in the relatively protective environment of a cargo distribution container or high-priority airlift pallet can expect to be exposed in the theater of operations. Recently, the National Maintenance Program was experiencing a high "wash out" rate of unserviceable items being returned. The damage did not happen in combat but rather in transport. The high failure rate was attributed to inadequate packaging to survive extreme temperatures, humidity, rain, wind, salt, sand, dust and dirt.

From February through April 2005, ECBC personnel provided support to military packaging efforts in Camp Arifjan, Kuwait, including shipping, distribution and retrograde operations. Retrograde operations require the shipment of damaged but fixable items from theater for repair, refurbishment and, eventual return to service. Due to the high failure rate of retrograde material, the Department of the Army initiated an Army Materiel Command-sponsored effort to improve retrograde packaging operations and streamline packaging practices. In response to this needed improvement, ECBC provided hands-on support and guidance to the retrograde packaging processes.

In Kuwait, ECBC provided instruction to military personnel and guidance to contractors working in retrograde operations, including preservation, packaging and marking requirements for items being shipped back to the United States for repair. ECBC also instructed troops in fabricating shipping crates in accordance with military standards.

To improve operations and standard procedures, ECBC personnel developed lists of equipment and materials required for efficient operation. Guidance was also provided to demonstrate proper packing procedures to obtain optimal cube utilization of 20-foot containers. Detailed instructions were provided to warehouse and supplier personnel to address hazardous material shipment concerns and the related safety issues.

In Kuwait

Installing Chemical and Biological Attack Warning Systems in Kuwait Ports

Thousands of containers and people, and many ships, trains, planes and trucks pass through a port each day in order to move items to a destination. From a military standpoint, a port is the primary point where troops and equipment converge on the way to or from a theater of operation. A terrorist strike at a port, particularly if it involved weapons of mass destruction, could bring a country and a military operation to a halt.

In cooperation with the Air Force Research Laboratory, ECBC installed the Port Warning and Reporting Network System at the Port of Ash Shuaybah, Kuwait in September 2005. Commonly called PortWARN, this system is an integrated hardware and software network that provides a commander with situational awareness to include near real-time display of detector data, event management, hazard prediction and messaging. The system is made up of a series of detection nodes that communicate with a central command post through a remote data relay by either radio or Ethernet. Each detection node consists of a light tower, detector, solar panels, meteorological sensors and batteries and looks for both chemical agent and various toxic industrial chemicals. These nodes can be mobile and placed wherever a threat is perceived or operations require.

All port events, including fire, medical emergencies, intruders, facility damage and road blocks are entered into the system and tracked on a military map-based display along with reports from the detectors. Hazard predictions are then generated and available to port authorities and operational commanders.

The PortWARN system integrates nuclear, biological and chemical reports generated from other systems. Should an event occur, the system can send reports to higher headquarters, notify the port workers, and instruct alarms on the nodes themselves to activate visual and audible warnings, such as strobe lights and voice sirens. ECBC conducted a successful demonstration for military planners in June 2005 of the interoperability of PortWARN with other situational awareness tools.

In 2005, ECBC provided additional chemical and biological defense technologies for the Port of Ash Shuaybah designed to integrate with the PortWARN system. Dry filter units were installed to provide a biological sample collection and detection capability and a two-tent collective protection unit was installed to provide personnel decontamination capabilities. A blood diagnostic tool for determining chemical agent exposure was provided to the port's medical clinic, and escape hoods were supplied to dockside workers. Large- and small-scale decontamination systems were provided and transportation and distribution workers and troops were trained on their use. In 2006, the PortWARN System and related technologies will be installed at Kuwait Naval Base.

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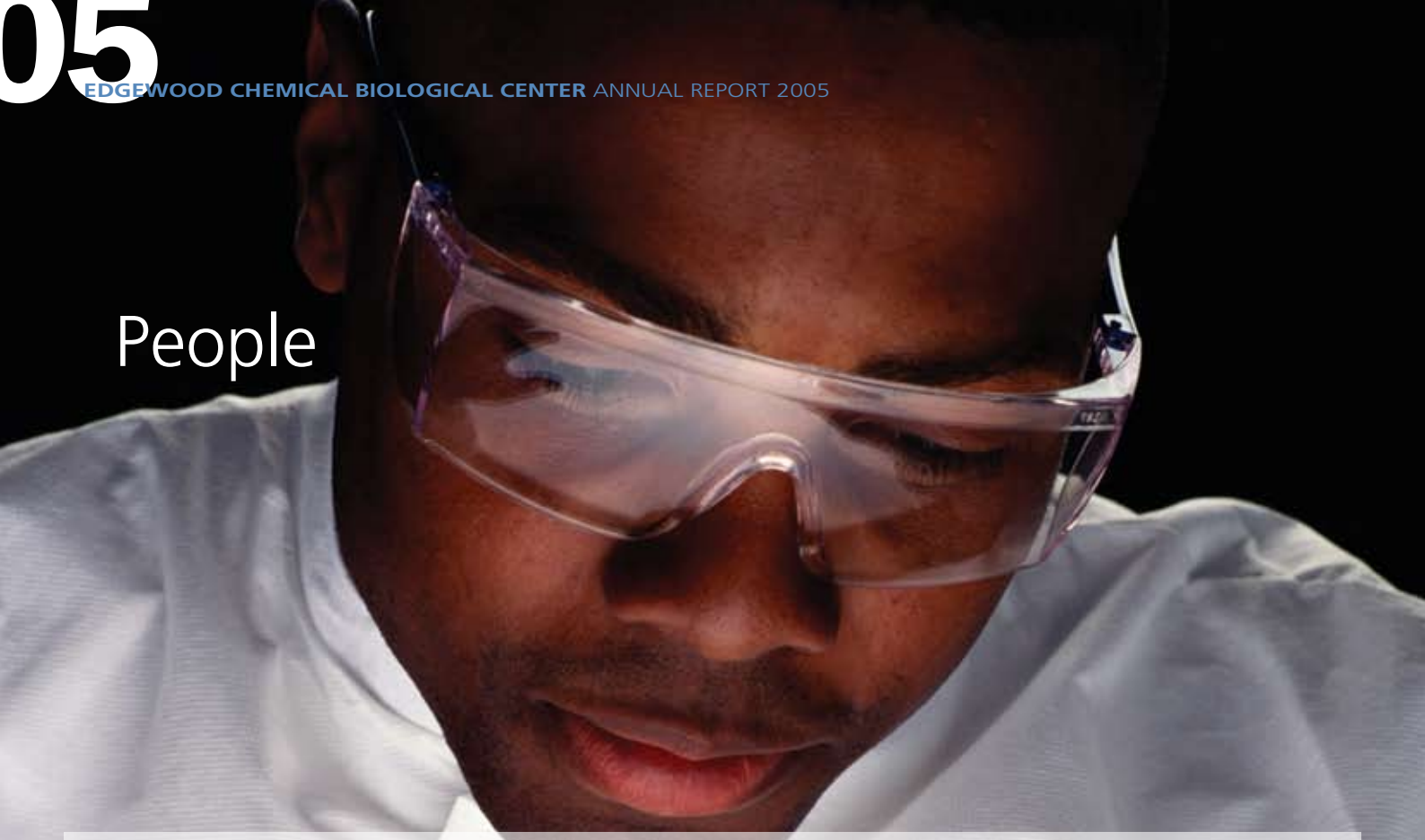
REPORT ON RESOURCES



People

A vibrant, well-trained and motivated workforce is the backbone of any organization. For ECBC, this holds especially true as each day ECBC scientists and engineers must safely handle extremely toxic materials in order to conduct studies that strengthen our nation's defense against weapons of mass destruction. This requires a high level of personal commitment to the warfighter, national security and the advancement of science and technology.

With its staff expertise, infrastructure and 90-year history, ECBC has the world's single most robust capability in safely working with the world's most toxic materials. Maintaining this unique capability is critical to our nation's defense. In 1999, recognizing that impending retirements could result in a catastrophic loss of institutional knowledge, ECBC began actively recruiting talented scientists and engineers at all levels—from recent college graduates to seasoned professionals. The goal was to attend to the impending loss of experienced personnel with a wave of capable new hires to work alongside them and learn from their expertise. At the completion of FY05 that wave of new hires had swelled to almost 600 new staff members—half of the Center's workforce —and had infused new technical skills and leadership ideas throughout the organization.

At the end of FY05, ECBC's workforce included 1,167 government employees and 396 on-site contractors.

During FY05, ECBC hired 144 new government staff members and lost 61 staff members to retirements or reassignments, leading to a net growth from FY04 of 83 employees. These statistics represent the beginning of a planned slow-down in workforce growth as ECBC has reached its recruiting and hiring goals. And as ECBC's hiring slowed in FY05, the Center's attention turned to employee development and retention activities aimed at senior and future leaders as well as new employees.

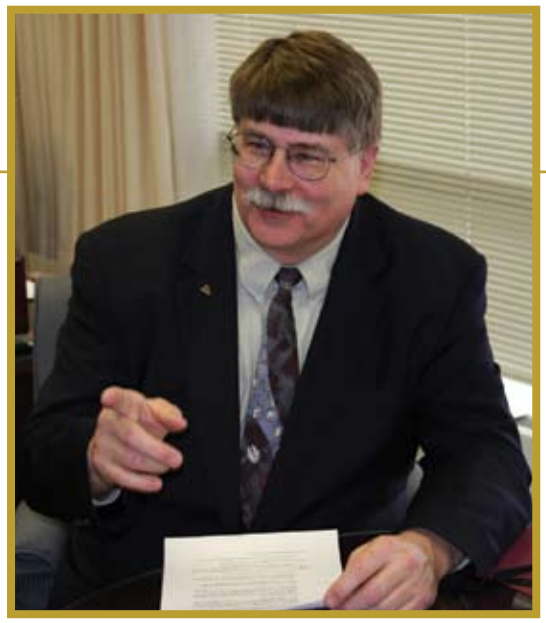
Working through the Office of Personnel Management, ECBC brought in experts from C2 and the Hay Group to provide executive coaching for senior leaders in preparation for strategic planning and leadership development activities. This effort was designed to assess the strengths, capabilities and weaknesses of the ECBC senior leadership. The Hay Group conducted 360° evaluations of senior leaders as well as individual coaching. Additionally, high-performing mid-level managers and employees were selected to participate in a Leadership Cohort in FY05. In this program, future leaders of the organization gain perspective on issues affecting the Center, work with senior leadership and closely collaborate with peers on special projects.

In FY05, ECBC launched its second formal mentoring class, which consisted of 12 mentor-protégé teams across all directorates. This nine-month program was designed to provide new employees who have been identified as potential future leaders of the organization with opportunities to access the experience and knowledge of more senior-level staff. Mentees work directly with senior staff members on a variety of in-classroom and informal development assignments.

A major initiative at ECBC in FY05 was the upgrading of internal communications systems. In September a new Intranet that improves Center-wide knowledge management and is a source of up-to-the-minute news was launched. Increased collaboration between teams and a better understanding of ECBC's full capabilities by the workforce are two goals of the Intranet. Leader-to-workforce communication was also increased, through e-mail and quarterly town hall meetings, and by reporting on issues that have impact on the workforce.
ECBC is committed to continuously offering development opportunities to staff members and supporting them as they conduct the important work of improving our nation's chemical and biological defensive posture.

People

Spotlight: Rick Decker



On February 14, 2005, Mr. Richard (Rick) Decker II, became ECBC's Director of Engineering and a member of the Senior Executive Service. In this capacity, he oversees the development, engineering and sustainment of chemical and biological defense equipment. Mr. Decker is responsible for approximately 600 employees with expertise in engineering, logistics and acquisition. In both industry and government, his career has focused on work in the areas of protective equipment and smoke/obscuration equipment acquisition. Mr. Decker graduated with a BS degree in chemistry and mechanical engineering from the University of Maryland. He and his wife of 32 years, Sue, who is a physician, have two children.

When did you begin as Director of Engineering and what made you want the job?

I began working as the Director of Engineering on 20 Feb 2005. I wanted an opportunity to help the Engineering Directorate and ECBC workforce and to share my experiences and knowledge from having worked with the Joint Program Executive Office for Chemical and Biological Defense. ECBC is an extraordinary place with exceptional subject matter experts who are passionate and talented across the full spectrum of the chemical and biological defense program. They have met the challenges that faced our Nation during Desert Shield/ Storm, after 9-11, and during Operation Enduring Freedom/ Operation Iraqi Freedom and I am very proud to be a part of this organization.

What changes have you made since you became Director?

The first change that I made was to strengthen the Engineering Directorate office. I added structure to address the current and future customer base. Engineering Directorate is 100% customer reimbursable; therefore, our customers are extremely important. I now have three key managers, AJ Thornton, Deputy Director, William Klein, Resource Management and Life Cycle Support, and Suzanne Milchling, Joint and Interagency Activities that have direct alignment with our customer base. I also established a Leadership Cohort Group at the GS-13 level. I believe that it is important to have a series of generations ready to lead the organization, to be ready for consideration for additional responsibility and authority. We focus on both professionalism and human development in which leadership is a huge part. It is critical to maintain our intellectual knowledge and provide mentors that can shape and mold the new leaders of tomorrow. This is critical since our reputation defines our future.

Tell us about the reorganization of the directorate. How has the reorganization benefited customers and how has it benefited your staff?

I created a straight line of communication between our customers by creating an advocate starting in my front office. In most cases, I allowed the advocate to choose their customer base. This new organization alignment has resulted in several new starts. Client managers approach the customer, offer them ideas of how Engineering Directorate can better support them and the process works. For example, the Filter Alternate Source Qualification program, the customer (the Joint Project Manager Individual Protection and Collection Protection) was contacted and a comprehensive review and identification of possible new alternate filter technology was suggested. They jumped at the opportunity to use this formal acquisition technical approach to take advantage of improvements in technology to expand the life cycle and operational capability of legacy chemical and biological items.

What technical accomplishment are you most proud of during the 2005 timeframe?

I am most proud of the accomplishments when the entire Center works together to solve a problem that will support the Warfighter. Through integration and cooperation from basic research, concept development, and engineering, along with input from the Joint Project Manager for Nuclear, Biological and Chemical Contamination Avoidance, we worked together recently to provide a new sensor detection capability for non-traditional agents in response to an urgent need statement from the Warfighter.

What do you like most about your position?

The most important ingredient of success is the people and I enjoy working both internally and externally with people.

What was your last job?

I served as the Deputy to the Program Executive Officer for Chemical and Biological Defense under BG Stephen V. Reeves, Falls Church, VA which was a developmental assignment which lasted nearly three years. I had an extraordinary experience there which afforded me numerous opportunities to work within the Pentagon and Congressional communities. I would highly encourage anyone to take a developmental assignment to work in the Pentagon, Department of Defense or Other Government Agencies in the Washington D.C. area.

Awards and Recognition

Meritorious Civilian Service Award received by:

- Dr. James Baker for his successful support to the warfighters and other government agencies. Dr. Baker has helped lead ECBC through a period of extensive growth. Over the past five years, ECBC has increased staff by 20 percent. His superior leadership and extensive scientific background was critical to ECBC during this time of great change.

- Monica Heyl for her outstanding performance and significant contributions to the Department of Defense. Ms. Heyl has established herself as a recognized national and international leader in mobile chemical and biological laboratory design and development. Her exceptional technical and managerial skills have been sought repeatedly by various government agencies requiring the design and construction of a variety of mobile analytical labs. Her most recent success is the development of chemical and biological laboratory systems for the 20th Support Command.

Superior Civilian Service Award received by:

- Gary Doggett for exceptionally meritorious service while assigned as the Principal Science Advisor for the Army Materiel Command, Logistics Support Element-Southwest Asia in support of Operation Iraqi Freedom. His outstanding, dynamic skills and participation during combat operations were essential in support of ground combat forces on the battlefield. He served as a cornerstone to the overall success of the mission, while enduring an extremely difficult and hostile environment.

- James Byrnes for his role as an Intelligence Specialist for ECBC. His dedication and unique skills ensured the success of various projects such as the full integration of intelligence and threat into the entire Joint Nuclear, Biological, and Chemical Defense Research Development and Acquisition program, the enhanced sharing of foreign technological information in ECBC's mission areas from the Army Materiel Command Science and Technology Centers, and establishing a set of policies for integrating validated intelligence into Joint Chemical and Biological Defense Programs.

- Dr. Randy Long for his role as a Physical Scientist for ECBC. Dr. Long also served as Chair of The Technical Cooperation Panel for Chemical Biological Defense, Technical Panel 10 for Detection of Biological Agents. He proved to be the cornerstone of the collaborative relationships the United States now shares with the United Kingdom, Canada, and Australia CB Defense agencies in the areas of genetic technology, recombinant antibodies, immunosensors, mass spectrometry, and physical approaches to biological detection.

2005 Army Research and Development Achievement Award received by:

- Dr. Michael Jakubowski for his work in developing analytical chemistry techniques that permit identification and quantification of chemical nerve agents in body fluids and tissues. These techniques have proven to be valuable and essential tools for developing predictive models of health risks associated with low-level chemical nerve agent exposure.

Outstanding AMC Personnel of the Year Award received by:

- Ray Mastnjak for his continual demonstrations of outstanding leadership through his utilization of state-of-the-art management approaches, which have resulted in establishing program priorities and ensuring completion of goals in one of the Army Materiel Command's highly technical environments.

- Dr. George Famini for his role involving directing, developing, and overseeing international cooperative activities. Dr. Famini has been instrumental in establishing formal laboratory-to-laboratory collaborations with key allies in Asia, North America, and Europe.

Defense Standardization Program Award received by:

- Dr. Jose-Luis Sagripanti, for his work in the development of a standard test method for efficacy of decontamination products that was adopted by ASTM International as Test Method Standard E 2414-05, "Test Method for Quantitative Sporicidal Three-Step Method to Determine Sporicidal Efficacy of Liquids and Vapor or Gases on Contaminated Carrier Surfaces."

- Dr. George Famini, Robert Moeller, and Cecelia Ball for their efforts supporting the American, British, Canadian, Australian Armies' Quadripartite Working Group on Nuclear, Biological, and Chemical Defense.

APG Outstanding Woman of the Year Award received by:

- Dr. Pamela Barrett for her commitment to the overall career development of the women of ECBC. Dr. Barrett's exemplary performance in mentoring the women of ECBC to reach out and embrace career challenges.

2005 Award for Excellence in Technology Transfer received for:

- The Biological Sampling Kit, a portable, disposable device that can collect biological contaminants from surfaces. The kit plays a vital role in biodetection, nonproliferation and forensic analysis communities. It is licensed to Quicksilver Analytics for manufacture for military and private sector customers. ECBC awardees on behalf of the Biological Sampling Kit: Dr. Peter Emanuel, Mark Schlein, Kevin Wallace, Peter Schlitzkus, and Donna Cannella

- Automated Decision-Aid System for Hazardous Incidents, a computer-based tool that allows emergency management authorities to manage a hazardous or WMD incident. ECBC awardees on behalf of the Automated Decision-Aid System for Hazardous Incidents: James Genovese

Baltimore Federal Executive Board, 2005 Excellence in Federal Career Awards silver winners:

- Mr. Charles E. Henry for his rapid design and development of mobile labs and analytical sampling kits in support of the Joint Services Installation Pilot Project. Mr. Henry's innovative ideas enabled all six transportable prototype labs to be fabricated, equipped, shipped, and installed on DOD installations throughout the US on time or ahead of schedule.

- Mr. Lester D. Strauch for his support to the M256 Low Volatility Heater adapter, Specialized Computer Aided Manufacturing and the NBC Smartmarker. He applied state-of-the-art rapid prototyping and rapid tooling technologies with conventional machining and Computer Aided Manufacturing to accomplish the most effective, expedient and efficient solutions to defense development and production efforts.

- Mr. Steven D. Norman for his pro-active approach and technical skills, which are credited with enabling the successful development of the new procedures for the ton container draining process at both military and client facilities. His lead on several vital projects has had a positive impact on the defense of our Nation and our warfighters' safety on the battlefield.

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Infrastructure

Several years ago, ECBC set out to transform its research and engineering infrastructure into a state-of-the-art chemical and biological defense research campus. This was necessary so that ECBC could continue to fulfill its urgent and expanding national mission. In 2005, ECBC made enormous progress toward meeting this goal with construction of new facilities as well as renovations of existing buildings.

In 2005, ECBC opened its new Advanced Chemistry Laboratory, a 75,000-square foot facility designed for working with surety compounds. Highly instrumented and adaptable, primary facilities within the laboratory include advanced toxic agent laboratories, environmental chambers and secure work spaces for classified materials. Chemical agent operations conducted in this building will be analytical chemistry, Chemical Weapons Convention treaty support, filtration and decontamination technology development and evaluation of chemical agent detectors. A central feature of the lab is the Nuclear Magnetic Resonance suites, where scientists will study the properties and effects of chemical threat materials.

On October 5, 2005, ECBC held a ceremony dedicating the building to Dr. Edward Poziomek, a former ECBC director of research. The ceremony was attended by many elected officials, Department of Defense officials, media, ECBC employees and the Poziomek family. Visitors and media representatives were toured through the facility.

Also in October, ECBC broke ground on its newest facility—the Chemical Biological Radiological Sample Receipt Facility. This facility will serve as the only full-range national resource to receive, triage, sample and screen "unknowns" coming from military theaters of operation, intelligence organizations and law enforcement agencies. The new facility will allow disassembly and evidentiary exploitation of improvised terrorist devices and munitions, including explosively configured munitions. It will also expand ECBC's current capabilities to include use of robotics, gamma irradiation and non-intrusive detection. Technicians will also be able to conduct remote intrusive sample processing of explosive munitions, high-throughput sample bar coding and preprocessing including a solid chain of custody system and agent neutralization and detoxification. The facility also includes a containment capability for biologicals/toxins. The new 30,000 square-foot facility is scheduled for completion in 2007.

In last year's Annual Report we described the Standoff Detection Evaluation Technology Facility, a prototype facility constructed to allow precise performance measurement of standoff detection systems. The main feature of this facility is a Vortex Chamber, which utilizes a curtain of air to contain a homogenous material cloud allowing scientists to release and maintain a calibrated material scatter so that a stand-off detection system positioned up to several kilometers away can be accurately evaluated under true environmental conditions. In 2005, we began construction on a permanent facility to house the Vortex Chamber and completed the exterior of the new building. This new facility is scheduled to be completed in 2006 and operational in 2007.

ECBC is actively engaged in understanding emerging and new threat agents and has been developing a unique infrastructure for testing and evaluating equipment against these threats. In 2005, the design for the Next Generation Aerosol Chamber was finalized. This facility is currently under construction and expected to be completed by the end of 2006 and operational in 2008. This new facility is a critical component of ECBC's ability to protect and defend the warfighter and the nation against emerging chemical and biological threats.

In 2005, ECBC also improved its existing facilities and added additional laboratory capacity by converting administrative space to laboratories. Toxicologists, microbiologists, chemists and filtration specialists will all see improvements to their specialized laboratory workspaces in order to accommodate a growing workforce and expanding customer base.

New construction, renovation and continued maintenance and upgrade of ECBC's infrastructure are critical to our country's ability to address the chemical and biological threat. In 2005, ECBC achieved major milestones in this area.

FINANCIAL

FY 05 REVENUE (In Millions)

ARMY FUNDING	
RDT&E	
Basic Research[1]	1.9
Exploratory Development[2]	3.2
Advanced Development[3]	0.1
Demonstration and Validation[4]	1.0
Management Support/SBIR[5]	8.4
ARMY OMA[6]	15.0
ARMY WORKING CAPITAL FUND[7]	4.5
TOTAL ARMY FUNDING	**34.1**

DoD MISSION FUNDING	
CHEM-BIO DEFENSE PROGRAM	
Basic Research[8]	1.6
Applied Research[9]	34.5
Advanced Technology Development[10]	28.1
Demonstration and Validation[11]	18.0
Management Support/SBIR	1.5
JPEO[12]	104.3
DTRA[13]	15.7
DARPA	12.8
CMA[14]	27.9
Army PMs, PEO[15]	2.9
TOTAL DOD MISSION FUNDING	**247.3**

OTHER DoD FUNDING	
Army Customer[16]	10.7
Corps of Engr[17]	4.8
Navy[18]	3.0
Air Force[19]	7.5
Defense INTEL[20]	2.1
Marines[21]	7.5
Other DoD[22]	1.2
TOTAL OTHER DoD FUNDING	**36.8**

NON-DoD FUNDING	
Dept of Homeland Security[23]	13.5
Dept of Justice	22.5
EPA[24]	1.5
INTEL and Law Enforcement	14.1
Other Federal Agencies[25]	8.9
Commercial Accounts[26]	10.2
TOTAL NON-DoD FUNDING	**70.7**

CONGRESSIONALS	
Army	5.3
OSD	54.7
TOTAL CONGRESSIONALS	**60.0**

GRAND TOTAL ALL FUNDING	**448.9**

LEGEND

[1] In-house Laboratory Independent Research (ILIR) projects

[2] Army Smoke and Obscurants Program

[3] Virtual War Games Simulation

[4] Contractor Owned Contractor Operated (COCO) Surety Program

[5] Mgt support, Small Business Innovative Research, STTR

[6] Industrial base, CLS, and sustainment activities.

[7] Support for secondary components of chem bio major end items

[8,9] Research funding from the Chemical and Biological Defense Program Joint Science and Technology Office

[10] Supported standoff detection of non traditional agents, point detection using spectroscopy, decontamination against non-traditional agents, and technical evaluations.

[11] CUGR, CASPOD

[12] Support to Joint Program Executive Officer for Chemical and Biological Defense and PM Contamination Avoidance with matrix personnel, projects, contracts

[13] Counterproliferation Program

[14] Matrix personnel and testing and evaluation support for destruction of chemical agents

[15] PM ACWA, PM CIE, PM CCS, PM COMBAT

[16] Support to other elements of RDECOM, Army Installations, Army HQ, 20th Support Command

[17] Research and Development

[18,19,21] Installation Preparedness Support

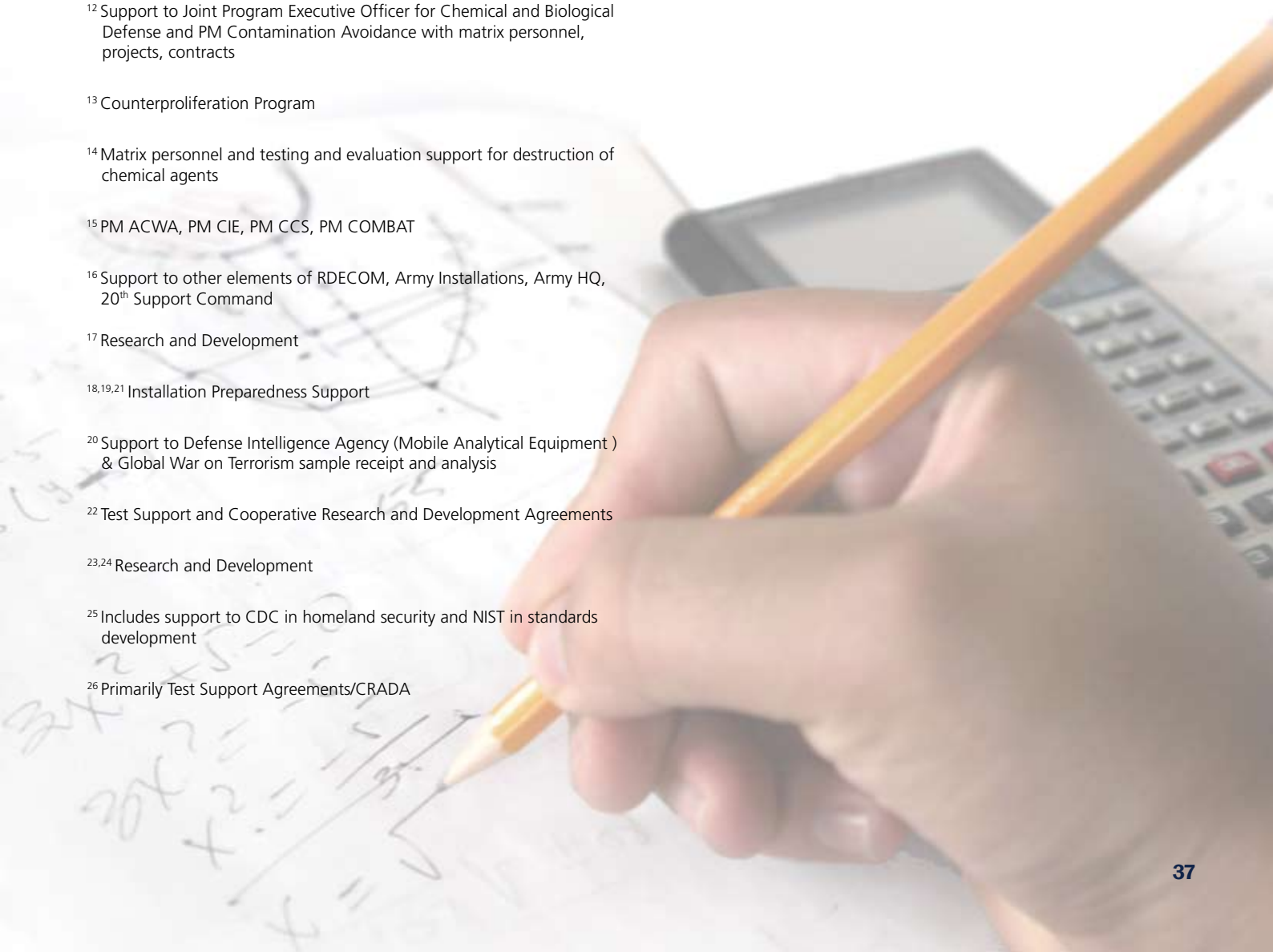
[20] Support to Defense Intelligence Agency (Mobile Analytical Equipment) & Global War on Terrorism sample receipt and analysis

[22] Test Support and Cooperative Research and Development Agreements

[23,24] Research and Development

[25] Includes support to CDC in homeland security and NIST in standards development

[26] Primarily Test Support Agreements/CRADA



Team Accomplishments

Research And Technology Directorate

Applied Test
Provided comprehensive test data used to certify a new source of paper for use with M256A1 kits, due to the manufacturer discontinuing production of the paper. New concept of operations also required additional capability in the paper. Generated test data on blister agent, nerve agent and semivolatile compounds of concern. Working with the manufacturer of both the kits and the paper, production of the paper was restarted -- the goal being to produce enough paper for the next five years.

Biochemistry
Discovered an approach to estimate survival of potential viral warfare agents after their release at a disparate set of locations and times of the year. This new understanding of viral agent fate in the environment will support the development of new consequence management strategies and help to clarify and redefine military requirements for the development of pertinent countermeasures. This accomplishment was valuable for developing a novel approach to predict the survival of viruses in the environment that will guide military doctrine on biological defense and will expedite recovery of military and civilian assets after a biological attack. Research published in *Journal of Virology*, November 2005.

Forensic Analytical
Supported Operations Iraqi Freedom and Enduring Freedom through deployment of specialized mobile laboratory and personnel who analyzed suspected chemical warfare samples in Iraq.

Mobile Labs and Kits
Designed, fabricated and delivered a suite of chemical and biological mobile laboratories for the 20th Support Command. Included specially designed analytical equipment and engineering controls. Also trained personnel on mobile laboratory operation and provided laboratory protocols and methodologies.

Aerosol Sciences
Partnered with the Department of Homeland Security to conduct objective experimental characterizations of performance of contractor-developed biological detection system components for the BioWatch Program, including aerosol samples and sample analyzers, at various stages of the research and development process.

Smoke and Target Defeat
Conducted studies of many materials and identified two that exceeded the goal to develop and test a dry powder obscurant with performance (mass extinction) four times current infrared obscurants. In fact, the obscurant material identified provides 10 times the performance factor of present materials, which increases survivability in the field. These new materials will be further explored as part of a FY06 Army Technology Objective to disseminate these new advanced infrared obscurants.

Operational Toxicology
Completed research focused on whole-body inhalation exposure effects of GF vapor in the swine and VX vapor effects in rodents, which is essential to confirming/updating existing estimates of exposures standards for humans. Specifically, discovered that nerve agents GF and GB are equally potent and that human estimates should be revised upward. The overall impact of this work is to refine accuracy of existing estimates of human health risks for both military and civilian populations, which determines the requirements for defensive equipment and affects concept of operations in the field. Researchers in this area published 23 presentations and publications in 2005.

Environmental Toxicology
New methods for investigating the fate of chemical agent on soil were needed. Designed and fabricated Soil System Units that allow determination of the fate of chemical warfare agents in soil, as well as investigation of the soil chemical and physical characteristics affecting the persistence of threat from continuing presence of agent in soil, under conditions that represent those in the field. For the first time, we were able to replicate and investigate the residual levels of GD found at hazardous levels in the field using the Soil System Unit approach. Results of our initial experiment showed that persistence of G-agent (GD) in soil can be expected for days following contamination. Furthermore, we established that life-threatening atmospheric levels of G-agent (GD) may be expected to successively reoccur in response to increasing moisture in soils contaminated with G-agent. Information generated on the fate of chemical agent on soil will be used for developing new guidelines for Warfighter operations and for response to homeland defense activities.

Biosensors
Conducted assay optimization and development of the Sector PR electrochemiluminescent Biodetection system in support of Department of Homeland Security. This device, a product of Meso-Scale Discovery, is a first generation plate-based analyzer, using biowarfare agent immunoassays fabricated on a proprietary screen-printed carbon electrode surface. Work involved assay optimization, increased throughput and an investigation into downsizing the platform. Multiple assays have been developed.

Molecular Engineering
Developed baculovirus as simulant for viruses used in laboratory and testing studies. Non-pathogenic to humans, the baculovirus resemble poxviruses in their physical construction, size and genome composition more closely than current simulants. Filed a patent application for the use of baculoviruses as simulant viruses in biodefense work. Pursuing a collaboration with the French Ministry of Defense research laboratory, the Centre d'Etudes de Bouchet, which also has an interest in simulant research.

Microbial Analysis and Products
For the Environmental Protection Agency, evaluated commercial fumigation technologies. The purposes of this evaluation was to: study the correlation between the decontamination efficacy of chlorine dioxide generated by two

processes; understand the ease of decontamination of carpet, ceiling tile, and I-beam steel relative to wallboard, wood and concrete; evaluate the decontamination efficacy of concrete and wallboard, and the necessity of multiple fumigation runs; understand the difference of recoveries from porous versus non-porous materials; and understand the impact of low temperature and low humidity. These findings will provide the Environment Protection Agency critical guidance for selection of appropriate building fumigants.

Point Detection
Development and implementation of a new proteomics-based method for the classification and identification of over 200 species of bacteria: This method integrates mass spectrometry based proteomic technology with a bacterial taxonomic database and numerical taxonomy methods to reveal genomic relatedness among bacteria. The unique readout of genomic information through ultra-fast sequencing of expressed gene products and bioinformatics methods allow for rapid classification and identification of microorganisms and their protein toxins. It may function as a strong complement to the alternative approaches of comparing microbial genomes based on DNA sequencing or microarray hybridization techniques.

Laser Standoff Detection
Transitioned Raman surface detection technology to the Chemical Biological Radiological Unmanned Ground Reconnaissance Advanced Concept Technology Demonstration and determined the final algorithm. This technology transition represents a significant improvement over the current mechanical method of conducting sampling and analysis of contamination on surfaces. Also calculated the Raman cross sections and populated a Raman repository for 10 neat chemical warfare agents and 38 toxic industrial chemicals.

Passive Standoff Detection
Demonstrated real-time detection of chemical vapor plumes in demonstrations at Huntsville, AL, Porton Down, UK and the Naval Surface Warfare Center in Virginia using the Adaptive Infrared Imaging Spectroradiometer technology. Completed upgrade of Adaptive Infrared Imaging Spectroradiometer to incorporate a 256x256 focal plane array operating at 5 scans/second. Results from all demonstration locations indicate that the sensor was able to detect and discriminate both the agent and simulants at extremely low release rates.

CB Technology Evaluation
Completed Technology Readiness Evaluation for detection systems. Tested 11 point biological identifier systems at Dugway Proving Ground against four pathogens in approximately 400 blind samples of varying concentrations. The systems were assessed in the areas of suitability, performance and maturity based on contractor provided information and the test results. The systems were assessed individually for application to three programs: Joint Point Biological Detection System, Guardian and Joint Biological Agent Identification and Diagnostic System. This was the first time that Technology Readiness Levels were assigned to all detectors tested.

Decontamination Sciences
Conducted demonstration of decontamination of C-141 airplane using modified Vaporous Hydrogen Peroxide technology at Davis Montham Air Force Base. Also conducted demonstration of decontamination of sensitive equipment at Tyndall Air Force Base. Results from both tests indicated modified Vaporous Hydrogen Peroxide is a viable technology for large-scale and sensitive equipment decontamination. Also redesigned technology to improve and miniaturize delivery systems. Expect technology to transition into joint service decontamination acquisition program in FY07.

Agent Chemistry
Completed non-traditional agent synthesis and study.

Chemical Biological Radiological Filtration
Transitioned novel sorbents to individual and collective protection programs. Four sorbents, which have the capability to remove toxic industrial chemicals such as ammonia, ethylene oxide, nitric acid, nitrogen dioxide, as well as traditional chemical agent, were incorporated into mask technology and large filtration system programs.

Respiratory Protection
Completed Defense Technology Objective project that resulted in the development of a low-cost, multi-agent End-of-Service-Life Indicator for protective mask filters. Assisted with transition to the Joint Service General Purpose Mask program. Also, validated the performance of a test system developed in-house to objectively monitor respirator lens fogging kinetics and to measure the impacts of lens misting on visual acuity in support of NIST and NIOSH CBRN respirator standards development and certification testing efforts.

Nuclear Biological Chemical Battlefield Management
Installed the Port Warning and Reporting Network System at the Port of Ash Shuaybah, Kuwait in September 2005. This system is an integrated hardware and software network that provides a commander with situational awareness to include near real-time display of detector data, event management, hazard prediction, and messaging. PortWARN will be used in the Fusion Cell of the port's operation center and will be operated by the 143rd Transportation Command and the Surface Deployment and Distribution Command. It was also installed at Kuwait Naval Base in January of 2006.

Modeling, Simulation, and Analysis
Defined analysis and modeling and simulation infrastructure for detection technology development managed by the Joint Project Manager for Contamination Avoidance. Developed master plan that laid out technological system milestone decisions and defined what analysis is required at each stage. A gap analysis was also completed to identify what additional modeling and simulation or analytical capabilities needed to be in place to support the analyses

Chemical Biological Systems Integration
Designed, fabricated and evaluated the TAC-BIO (TACtical BIOlogical); a low cost, low power, lightweight biological agent detector. Test bed designs successfully detected biological aerosols while rejecting a wide range of potential battlefield interferents. With a target unit cost of <$500 per detector, this technology could lead to an affordable means of achieving wide area surveillance and early warning against biological agent attacks.

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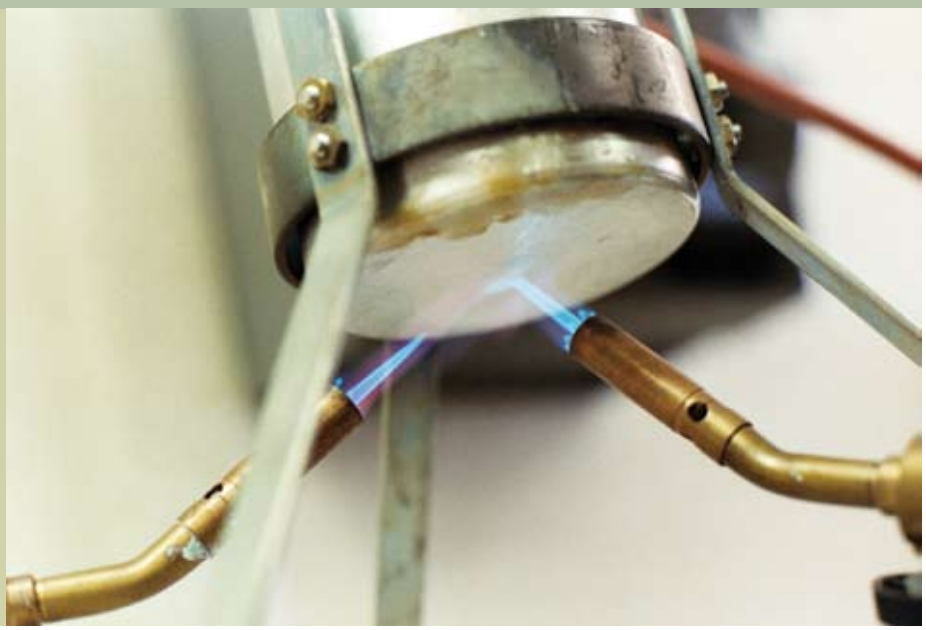
Team Accomplishments

Engineering Directorate



Test Technology Engineering
Conducted tests and performed contract negotiations to enable full-rate production of the Joint Service Mask Leakage Tester. The leakage tester is a portable device designed to test the serviceability and fit of protective masks. Completed two rounds of developmental testing to ensure all design and software changes were acceptable under all required environmental conditions. Also, completed a second operational test and evaluation to prove out several design improvements and upgrades. Created a spare parts pool to decrease turn-around time for maintenance. Once fielded, the mask leakage tester will provide the warfighter increased mask safety and ensure its protective value.

Collective Protection Engineering
The M93 filter is installed in small collective protection shelter systems to provide clean filtered air, but has been found to clog in dusty environments. The Collective Protection Engineering Team developed and tested a dust separator adaptor kit for the M93, which removes over 80 percent of dust in the air, resulting in extended filter life in dusty environments.

Respirator Engineering and Acquisition
Completed system demonstration of the Joint Service General Purpose Mask and began low rate initial production in support of the Joint Program Manager for Individual Protection. The new mask, which is to be fielded in 2006-2007 to warfighters from all services, offers improved protection and ease of use. Lower breathing resistance, higher filtration flow rates, increased protection against toxic industrial materials and improved system compatibility are features of this new mask.

Homeland Protection Engineering
Installed and certified filtration systems in numerous critical government facilities across the nation that require specialized collective protection to provide clean air after a potential chemical, biological or radiological attack. Provided continuous surveillance, preventative maintenance and regular re-certification of these systems.

Chemical Detection Engineering
Inspected and repaired hundreds of Improved Chemical Agent Monitors and M21 Automatic Chemical Agent Alarm systems in support of the Army RESET program that is focused on restoring equipment used in the field to a fully mission-capable status. Included conducting site visits at chemical units and installations throughout the United States and identifying equipment requiring service as a result of the increased pace of Army operations and employment of the equipment under extreme in-theater operational conditions. These actions will ensure that critical chemical defense assets supporting operational efforts are restored to fully mission capable status and noted hardware and system sustainment deficiencies are corrected to preclude future problems.

CUGR Advanced Technology Concept Demonstration
In 2005, the Chemical Biological Radiological Unmanned Ground Reconnaissance program faced issues that had potential to delay development of new reconnaissance technology by one year. In collaboration with other organizations, the team identified problems impeding progress with the surface detector software and restructured the program schedule to allow additional software verification testing. Operational demonstration testing will still take place in 2006, and the project will be completed as scheduled and original cost projections are still valid. Once fielded, CUGR will be a unique and valuable surface contamination detection tool for warfighters.

Decontamination Engineering
Support provided to current operations in the Gulf caused a large spike in demand for M17A3 Decontamination spare parts, quickly depleting the Defense Logistics Agency stock and adversely impacting system readiness. ECBC, working in partnership with TACOM, requested management of spare parts be returned for intense management and close technical control. Addressed special technical problems to ensure successful item procurements. Improved functionality of spare parts by applying equipment enhancements such as improved air filtration and protective caps. As a result, critical spare parts are available to restore M17s to fully mission capable status. Additionally, spare part enhancements improve the M17's survivability in the harsh desert environment.

Advanced Design and Manufacturing
Developed and fielded 3,000 Low Volatility Hazard Detector units within three weeks. The detector units, now known as the M256LVH Chemical Agent Detector Low Volatility Hazard Kit, advanced chemical agent detection capabilities for warfighters by enhancing the fielded M256A1 Chemical Agent Detector Kit. By adding a small plastic Sample Heater Assembly for simple sample containment and heating, and the use of the existing fielded M256A1 detection chemistry, the M256LVH provides the ability to detect the presence of low volatility hazards.

Smoke Engineering
Inserted the Starter Patch ignition method technology into the M18 Colored Smoke and M83 Training Smoke Grenade. Testing has been successfully completed on all four colors as well as the training grenade. The Starter Patch configuration ignites the grenades more efficiently, with the grenades producing usable smoke faster, especially for arctic-conditioned grenades. This configuration is also less sensitive to low fuze output.

Homeland Defense
Conducted field trials to determine the amount of a liquid contaminant that represents a hazard to special weapons and tactics officers during a response to a chemical warfare agent terrorist event. The data collected will be used to develop risk assessments and to provide operational guidance. The evaluation of the liquid transfer hazard has not been addressed in the past. Published six reports related to the subject in 2005.

Special Plans Office
Provided chemical and biological reachback to warfighters. Included experts from multiple rapid response programs that supplied subject matter expertise, hardware, and support on chemical and biological operations. Projects included conducting detailed analysis for a site in Mosul, Iraq, designing and fabricating a Sensitive Item Decontamination Unit, and supporting multiple training exercises.

DTRA-CBX
Managed commercial-off-the-shelf testing for the Department of Defense responders in coordination with the Joint Program Executive Officer for Chemical and Biological Defense and the Weapons of Mass Destruction Civil Support Teams. Testing was conducted on the AreaRAE; MultiRAE; QuickSilver Sampling Kit; BTC 650; and Draeger HAZMAT kit. This data will be used for Non Standard Equipment Review Panel's approval of these items for Department of Defense use.

Pyrotechnics
Demonstrated a new improved Advanced Incendiary Tool designed to support the US Naval Explosive Ordnance Disposal/Low Intensity Conflict. The demonstration showed greatly improved performance producing a complete penetration of MK82, MK83 and M117 bombs with a hole of a consistent diameter.

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Team Accomplishments

Chemical Biological Services Directorate

Explosive Destruction System
Successfully deployed the Explosive Destruction System, a mobile munition containment and destruction device, to Dover Air Force Base, DE and Aberdeen Proving Ground, MD to destroy one mustard-filled munition, one cyanogen chloride and seven hydrogen cyanide canisters. EDS testing was conducted with test items filled with mustard and lewisite. Personnel operated and maintained the EDS, manned the personnel decontamination station and performed air monitoring and laboratory analyses.

Munitions Assessment and Processing System
Supported concept, development and construction of the Army's Munitions Assessment and Processing System. This $12.9M system, located at the Edgewood Area of the APG supports both the installation's restoration program and the Program Manager for the Elimination of Chemical Weapons by safely treating all types of explosively configured chemical and smoke munitions found in those locations. Completed developmental and operational testing and prepared for start of operations in FY06.

Environmental Monitoring
Deployed to Tirana, Albania in May 2005 to support the Defense Threat Reduction Agency's Albania Chemical Weapons Elimination Program. During the field deployment, personnel performed storage container sampling, on-site agent analyses and sample preparation for shipment to the U.S.

Risk Reduction
Participated, on behalf of the Army Materiel Command, in the development of biological surety regulations that are now implemented throughout DoD. Also developed air monitoring methods for detecting new worker population limits (WLP), updated documents (e.g., SOPs, MSDSs, air monitoring plans, etc.), developed written plans and strategies for reacting to airborne detections (WPL Excursion Plan) and agent clearance methods for PPE to be laundered, and informed/educated the workforce of the changes to comply with the new Department of the Army chemical agent guidance, which introduced new airborne exposure limits to the classic (G, V, and H-type) chemical agents.

Pine Bluff Arsenal Munitions Assessment System
Initiated project to assess and repackage approximately 1,200 recovered munitions and several thousand Chemical Agent Identification Sets at Pine Bluff Arsenal in Arkansas. Provided air monitoring and agent screening of waste and protective clothing/protective equipment. In 2005, placed 16 support personnel on site to include chemists, operators and technicians.

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Team Accomplishments

Advanced Planning and Initiatives Directorate

International
Conducted quick-turnaround test program for Japan's Health and Medical Affairs. Evaluated Japanese physical protective equipment against realistic biological challenges. Tested collective protection filters, masks, and clothing using US military performance standards as performance measure.

Decision Analysis
Conducted a downselection study in support of the Project Manager for Smoke and Obscuration. This study was done as a follow on to a Functional Solutions Analysis, as part of the Joint Capabilities Integration and Development System process. Developed a methodology based on Multi-Criteria Decision Making to identify the best potential materiel solutions for small and medium area obscuration. The foundation for the analysis was an evaluation model, made up of weighted criteria with definitions and performance scales, which was used to assess each potential solution. Conducted an analysis of the model results and developed program recommendations in conjunction with the PM. These recommendations were provided as input to the Maneuver Support Center Battle Lab to be used in a war-game simulation model.

Technology Transfer
Achieved milestones with two industry partners. First, licensed enzyme technology to Genencor International, who now manufactures the decontamination technology under the trademark DEFENZ™. This decontamination technology was named a winner of the prestigious 2006 Award for Excellence in Technology Transfer by the Federal Laboratory Consortium for Technology Transfer. Second, transitioned the Modified Vaporous Hydrogen Peroxide decontamination technology, developed in conjunction with STERIS Corp., so that it is poised for incorporation into an acquisition program in 2007.

Chemical, Biological, Radiological, Nuclear and Explosive Training Team
Facilitated seminar on behalf of CENTCOM for Gulf Cooperative Council officers from Egypt, Jordan, Kuwait, Qatar and the United Arab Emirates on nuclear, biological and chemical topics. Seminar subjects included Toxic Industrial Chemicals, chemical agents (and precursors), decontamination, biological agents, biological detection with practical exercises in the use of the Hand-Held Assay and Biological Sampling Kit. The training was primarily conducted in White Marsh, Maryland and site tours included the Harford County Emergency Operations Center and the Aberdeen Proving Ground Ordnance Museum.

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ECBC FY05 Metrics

(October 1, 2004–September 30, 2005)

MANPOWER

- Total federal personnel: 1167
- On-site contractors: 396
- Average GPA of new hires: 3.25
- Staff with technical Masters: 238 total Master degrees held
  (includes administrative such as MBA)
- Staff with technical PhD's: 90
- Staff in Chemical and Biological Personnel Reliability Program:
  - TOTAL CPRP: 274 certified
    (Government employees – 225;
    On-Site Contractors – 49).
  - TOTAL BPRP: 81 certified
    (Government employees – 61;
    On-Site Contractors – 20)

TECHNOLOGY

- CRADAs and other in-kind programs with academia, industry/other Government agencies:
  - 16 new CRADAs with industry and academia
  - 39 new Test Service Agreements with industry
  - 8 new Inter-Agency Agreements with other government laboratories
  - 4 new Memorandums of Agreement with other government agencies
- Technologies transitioned—military and HLD —actual against business plan: 21
- Patents Awarded: 16
- Patent Applications Filed: 18
- Invention Disclosures: 27

AWARENESS

- External customers: 95
- Citations of research: 562
- Visits to www.ecbc.army.mil: 182,308
- Equipment Hotline Inquiries: 34

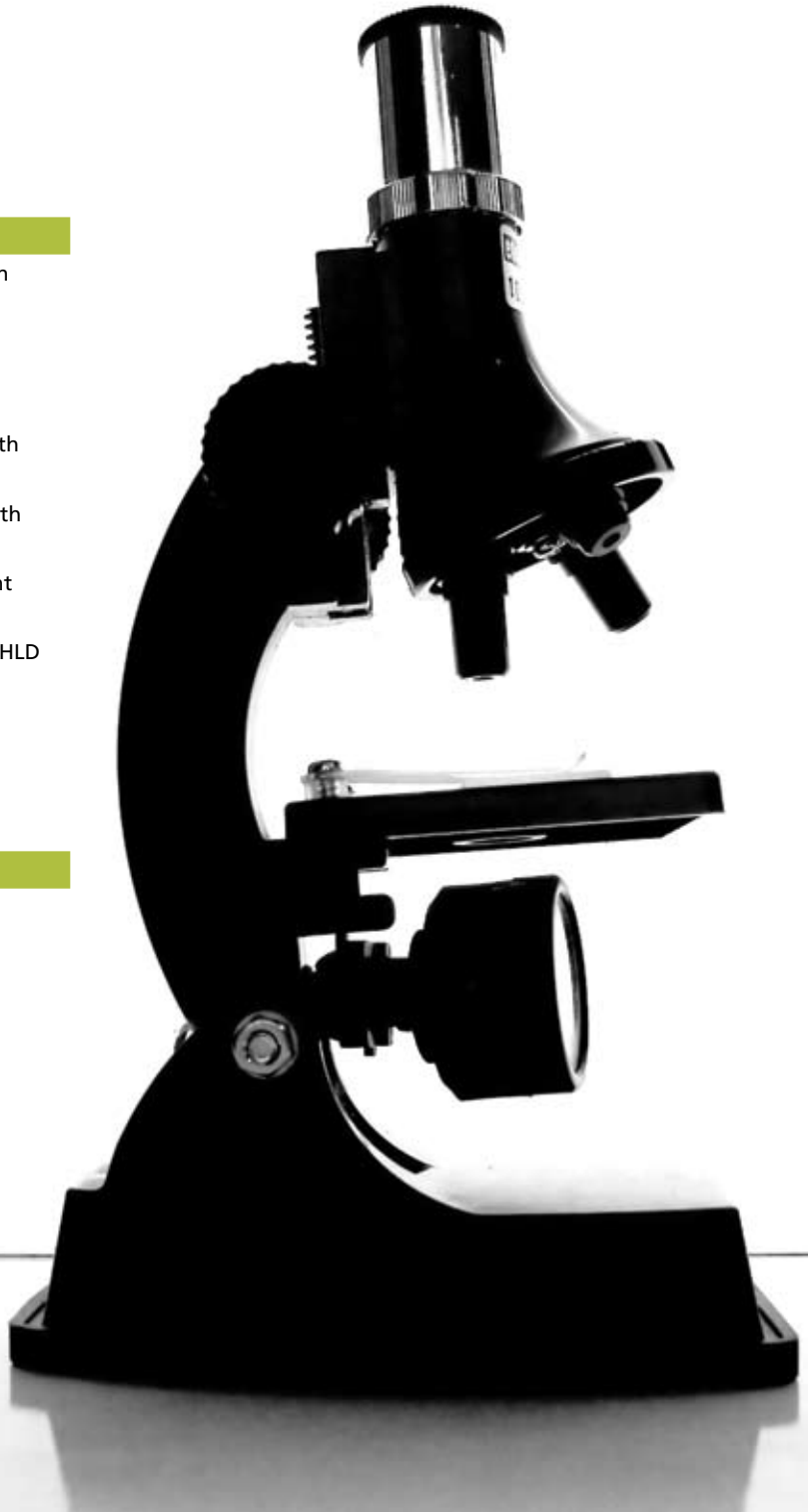

Photo captions

Cover: stock photo (left); The Advanced Chemistry Laboratory construction team in front of the finished building (top left); ECBC scientist analyzes samples from the mVHP decontamination demonstration (bottom left); Senator Barbara Mikulski visits ECBC (middle); An ECBC technician working in Albania (top right); ECBC scientist works in a mobile laboratory that ECBC built for the 20th Support Command (bottom right).

Inside front cover: stock photo.

Page 2: Jim Zarzycki, Director of ECBC.

Page 5: stock photo.

Page 6: stock photo.

Page 7: Scientists work in the ECBC's Aerosol Chamber (top); Test underway in a Wind Tunnel (center); ECBC scientists works in BSL 3 laboratory (bottom).

Page 8: mVHP units set up for decontamination demonstration of the interior of a military aircraft (top); ECBC scientist analyzes samples from the mVHP decontamination demonstration (center); Soldier wears the Joint Service General Purpose Mask (bottom).

Page 9: An M-1 Abrams Main Battle Tank enters Camp Caldwell in Balad Ruz, Iraq, after a nighttime route-clearing mission. U.S. Army photo by Spc. Gul A. Alisan.

Page 10: Ton containers. Photo courtesy Chemical Materials Agency.

Page 11: Scientists work in a mobile laboratory that ECBC built for the 20th Support Command.

Page 12: A Coast Guard Petty Officer mans an M-240 machine gun on board a Stingray MH-68A helicopter during a homeland security patrol around New York City. USCG photo by PA2 Mike Hvozda.

Page 13: stock photo.

Page 14: ECBC Scientists conduct an experiment under the Kids and Chemistry program (left and center); BG Roger Nadeau, Commanding General, Research, Development and Engineering Command, presents Larry Oswald, ECBC Engineering Technician, with the Aberdeen Proving Ground's Civilian Volunteer of the Year award (right).

Page 15: stock photo.

Page 16: Dr. Carol Brevett, SAIC, inserts a sample into the Nuclear Magnetic Resonance for an Agent Fate experiment.

Page 17: Dr. Terrence D'Onofrio, ECBC Research Chemist and Technical Deputy of the Agent Fate Program, demonstrates the ECBC designed and developed wind tunnel, which is capable of matching all of the desired environmental conditions, including temperature and wind profiles.

Page 18: Dr. O'Connell virus work.

Page 19: stock photo.

Page 20: Army Spc. Patricia Gracia, a laboratory technician from the 1st Area Medical Laboratory at Aberdeen Proving Ground, Md., extracts samples from suspect biological warfare specimens for testing in the Joint Biological Agent Identification and Diagnostic System. U.S. Army photo by Elaine Wilson.

Page 21: Dr. Charles Wick, ECBC, adjusts settings on the Integrated Virus Detection System.

Page 22: Solider uses the M21 (top); Small plastic adaptor that clips onto the M256A1 sampler, which heats a sample's temperature so that enough vapor is produced to allow detection to take place (bottom left); The M256A1 kit (bottom right).

Page 23: Air Force soldier wears the Joint Service General Purpose Mask, which protects warfighters against toxic materials (top); The Advanced Chemistry Laboratory Filtration System (background).

Page 24: A participant in a Weapons of Mass Destruction exercise is decontaminated. U.S. Marine Corps photo by Lance Cpl. Brandon E. Loveless (top); Material (center); Dr. Jose-Luis Sagripanti (sidebar).

Page 25: M12A1 front (top); M12A1 back (bottom).

Page 26: ECBC technician; Albania (background).

Page 27: Equipment waiting for packaging, shipping and repair.

Page 28: A mobile node of the PortWARN system.

Page 29: stock photo.

Page 30: stock photo.

Page 31: Rick Decker, Director of Engineering.

Page 32: stock photo.

Page 33: stock photo.

Page 34: ECBC's new Advanced Chemistry Lab allows scientists to work with the world's most super toxic compounds.

Page 35: (top to bottom) The Poziomek family gathers out front of the Advanced Chemistry Laboratory during the Dr. Poziomek dedication ceremony; Senator Barbara Mikulski with Dr. Vicky Bevilacqua, ECBC; Sample Receipt Facility rendering; Vortex Chamber.

Page 37: stock photo.

Page 40: stock photo.

Page 41: stock photo.

Page 42: stock photo.

Page 43: stock photo.

Page 44: stock photo.

For more information about
Edgewood Chemical Biological Center,
visit our Web site at:
www.ecbc.army.mil

Part of the U.S. Army Research,
Development and Engineering Command